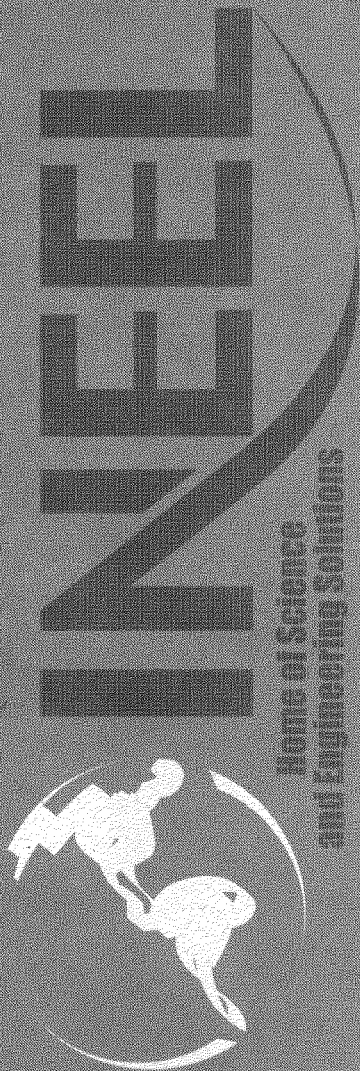


Health and Safety Plan for the VES-SFE-20 Hot Waste Tank System

June 2003



*Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC*

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**Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC
Idaho Falls, Idaho 83415**

**Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-99ID13727**

ABSTRACT

This Health and Safety Plan establishes the procedures and requirements used to eliminate or minimize health and safety risks to personnel performing remedial tasks within the VES-SFE-20 Hot Waste Tank project area located within the Idaho Nuclear Technology and Engineering Center at the Idaho National Engineering and Environmental Laboratory. This plan has been prepared to meet Occupational Safety and Health Administration standard, 29 CFR 1910.120, “Hazardous Waste Operations and Emergency Response Requirements.”

The operational safety basis for VES-SFE-20 project remedial actions is further evaluated in a company hazard assessment document. Additional operations will be evaluated by the unreviewed safety questions process, in accordance with company policies and procedures.

This plan contains the assessment and associated mitigation of safety, health, and radiological hazards for conducting remedial activities within the VES-SFE-20 Hot Waste Tank project area. Safety, health, and radiological professionals assigned to support this project will utilize this Health and Safety Plan as the basis for planning and hazard mitigation. Additional hazard controls and mitigation measures will be further defined based on project-specific conditions, and changes to this plan and associated work control documents should be made as appropriate.

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ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AL	action limit
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
anti-C	anticontamination
ARDC	Administrative Record and Document Control
ASA	auditable safety analysis
BBWI	Bechtel BWXT Idaho, LLC
CAM	continuous air monitor
CERCLA	Comprehensive Environmental, Response, Compensation and Liability Act
CFR	<i>Code of Federal Regulations</i>
CPP	Chemical Processing Plant
CPR	cardiopulmonary resuscitation
CRC	contamination reduction corridor
CRZ	contamination reduction zone
CWA	controlled work area
DAC	derived air concentration
dBA	decibel A-weighted
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EAM	emergency action manager
ECC	Emergency Control Center
ERO	Emergency Response Organization
ESH&QA	environment, safety, health, and quality assurance
EZ	exclusion zone

FECF	Fuel Element Cutting Facility
FTL	field team leader
GFCI	ground fault circuit interrupter
GI	gastrointestinal
H&R	hoisting and rigging
HASP	Health and Safety Plan
HASS	Hazards Assessment and Sampling System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air
HSO	health and safety officer
ICDF	INEEL CERCLA Disposal Facility
IDLH	immediately dangerous to life or health
IDW	investigation-derived waste
IH	industrial hygiene, industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRT	Incident Response Team
ISMS	Integrated Safety Management System
JSA	job safety analysis
LEL	lower explosive limit
LO/TO	lockout/tagout
MSDS	material safety data sheet
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NRR	noise reduction rating
OMP	Occupational Medical Program

OSC	on-scene coordinator
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCB	polychlorinated biphenyl
PCM	personal contamination monitor
PEL	permissible exposure limit
PEW	process equipment waste
PM	project manager
PPE	personal protective equipment
QA	quality assurance
QC	quality control
QE	quality engineer
RadCon	Radiological Control
RBA	Radiological Buffer Area
RCA	Radiologically Controlled Area
RCIMS	Radiological Control and Information Management System
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RE	radiological engineer
ROD	Record of Decision
RW	radiological worker
RWP	radiological work permit
SAD	site area director
SCBA	self-contained breathing apparatus
SFE	Storage Facility Exterior
SP	safety professional

STL	shift technical lead
STR	subcontractor technical representative
SWP	safe work permit
SZ	support zone
TLV	threshold limit value
TPR	technical procedure
TRAIN	Training Records and Information Network
TWA	time-weighted average
UV	ultraviolet light
VES	vessel
VPP	Voluntary Protection Program
WAG	waste area group
WCC	Warning Communications Center

Health and Safety Plan for the VES-SFE-20 Hot Waste Tank System

1. INTRODUCTION

This Health and Safety Plan (HASP) identifies health and safety hazards and requirements used to eliminate and/or minimize the hazards during remedial actions the removal, treatment (as necessary), and disposal of the Vessel (VES) Storage Facility Exterior (SFE)-20 tank, sediment, vault, access way, pump pit, ancillary piping, Chemical Processing Plant (CPP)-642 building, and underlying contaminated soils per Waste Area Group (WAG) 3 remedial action objectives. VES-SFE-20 is located next to CPP-603 inside the fence at the Idaho Nuclear Technology Engineering Center (INTEC) at the Idaho National Engineering and Environmental Laboratory (INEEL). This HASP has been written to meet the requirements of the Occupational Safety and Health Administration (OSHA) standard, 29 CFR 1910.120, “Hazardous Waste Operations and Emergency Response” (HAZWOPER). Additionally, the safety basis for VES-SFE-20 remedial activities will be evaluated using the unreviewed safety questions process, in accordance with applicable company documents and procedures.

1.1 Purpose and Applicability

This HASP has been prepared to address VES-SFE-20 project hazards and associated mitigation based on remedial actions to be completed at the VES-SFE-20 project site. It will be used in conjunction with other work control documents such as job safety analyses (JSAs), and applicable company policies and procedures to further define project hazards, mitigation, and procedural requirements as new hazards are identified. This HASP will be reviewed and revised, as appropriate, by the project industrial hygiene (IH), industrial safety, and radiological operations personnel to ensure its effectiveness and suitability for SFE-20 project activities.

The VES-SFE-20 project activities have been reviewed in accordance with applicable company policies and procedures and been categorized as a low hazard activity requiring an auditable safety analysis (ASA). Technical procedures (TPRs), JSAs, and other appropriate work control process evaluations will be conducted to ensure operations are conducted in compliance with the ASA. VES-SFE-20 project activities will fall within the INTEC site area director’s (SAD’s) jurisdiction.

This HASP governs all remedial activities of the VES-SFE-20 hot waste tank system performed by personnel of Bechtel BWXT Idaho, LLC (BBWI), subcontractors to BBWI, and employees of other companies or the U.S. Department of Energy (DOE) laboratories.

1.2 INEEL Site Description

The INEEL is a U.S. government-owned test site managed by the DOE and is located in southeastern Idaho, 51.5 km (32 mi) west of Idaho Falls (Figure 1-1). The INEEL encompasses approximately 2,305 m² (890 mi²) of the northeastern portion of the Eastern Snake River Plain.

1.3 INTEC Site Description

The INTEC, located in the south-central portion of the INEEL (Figure 1-2), commenced operations in 1952. Historically, the INTEC has been a uranium reprocessing facility for both defense projects and research, while also acting as a storage facility for spent nuclear fuel. Irradiated defense nuclear fuels were reprocessed to recover unused uranium. Liquid waste generated from these activities was either

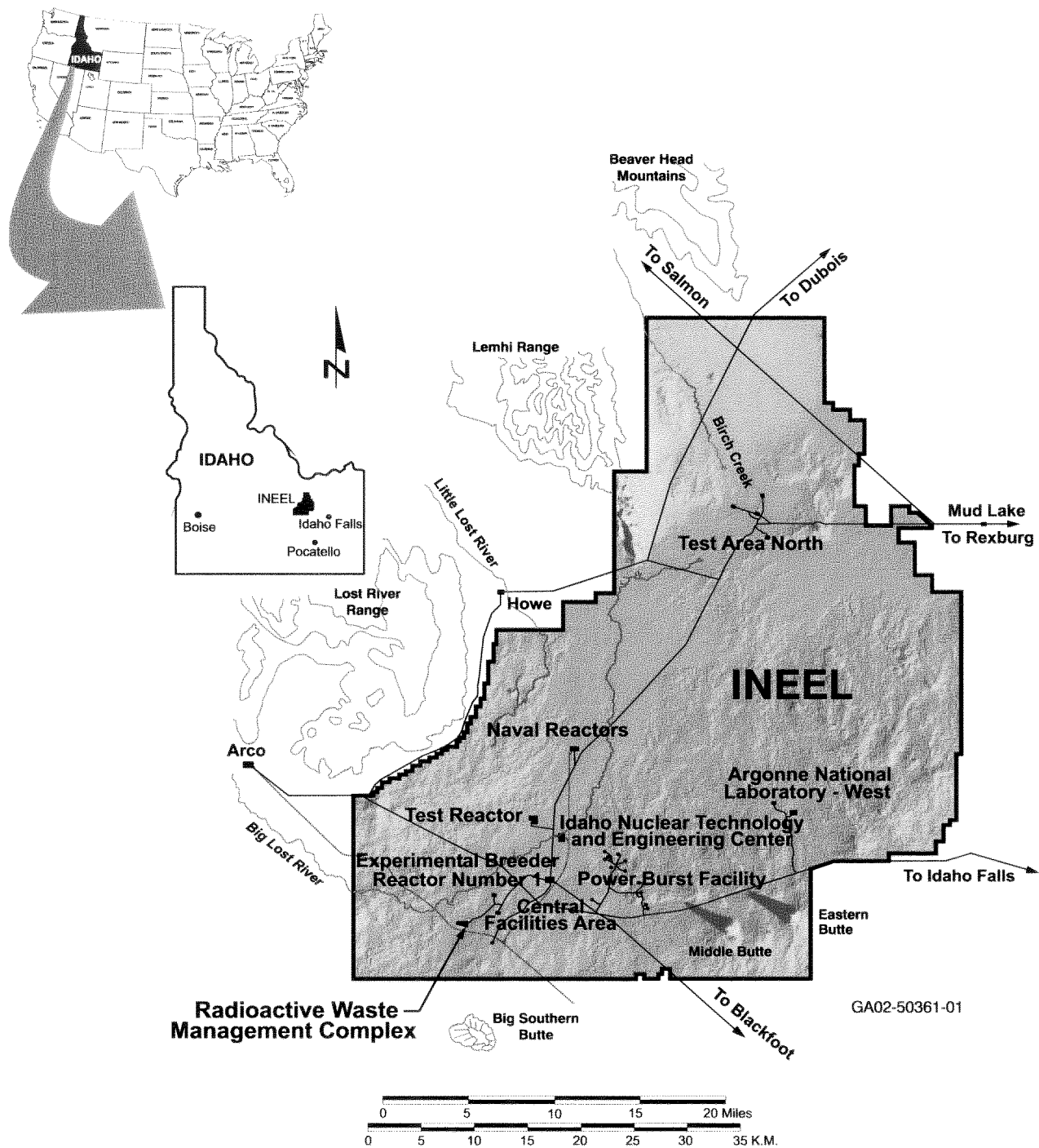


Figure 1-1. Map of the Idaho National Engineering and Environmental Laboratory.

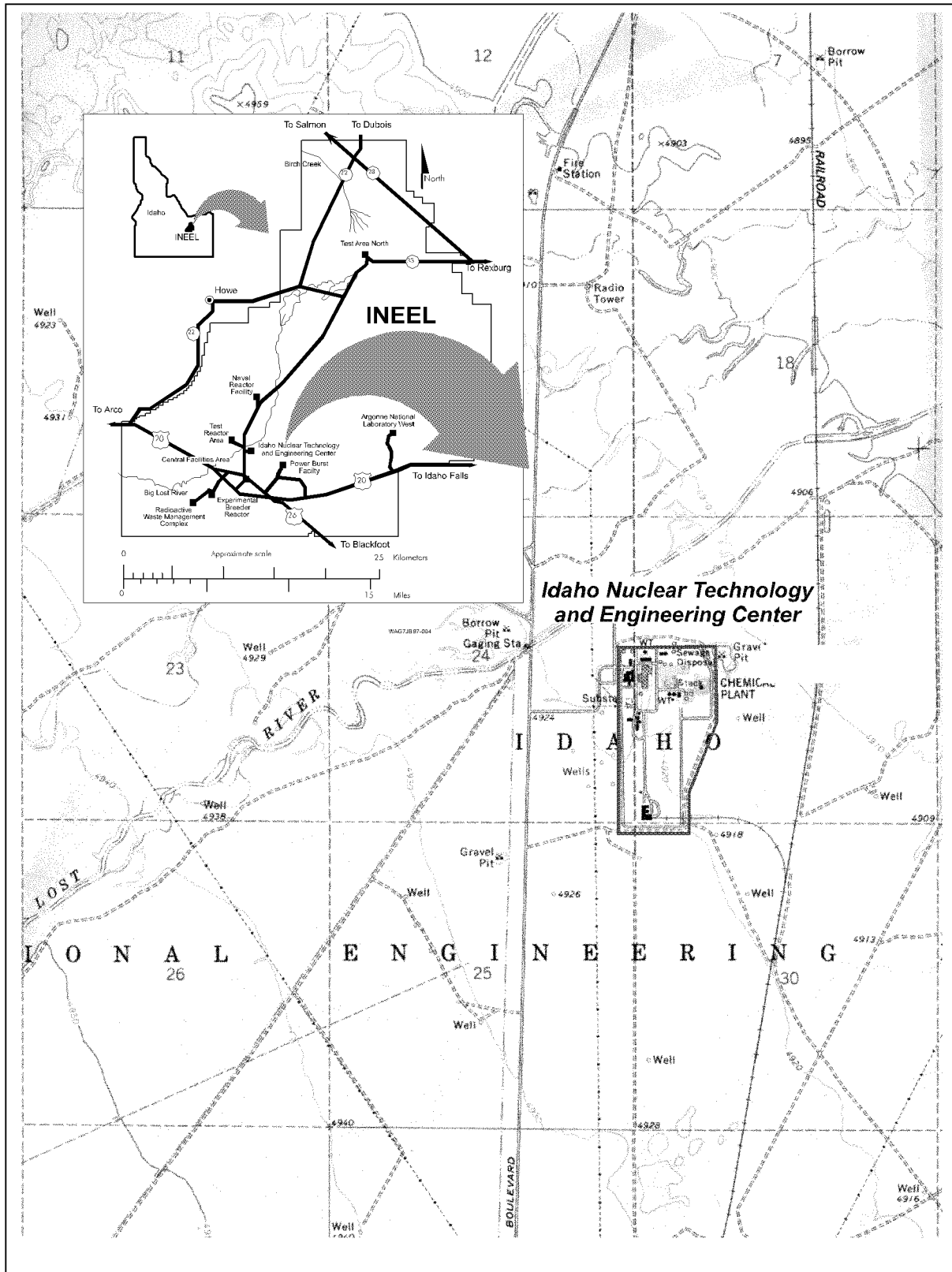


Figure 1-2. Map of the INTEC at the INEEL.

stored at the INTEC tank farm for treatment at the calcining facility or disposed of in the INTEC injection well, CPP-23. After fuel dissolution and extraction, the liquid waste was calcined, and the resultant granular solids were subsequently stored in stainless steel bins. Depending on the type of fuel reprocessing used, several types of high-level radioactive liquid waste have been produced at the INTEC. A phase-out of the INTEC's reprocessing activities began in 1992, including fuel dissolution, solvent extraction, product denitration, and other processes. The VES-SFE-20 tank vault and its associated pump house (CPP-642) are located east of CPP-603 near the south perimeter of INTEC (Figure 1-3).

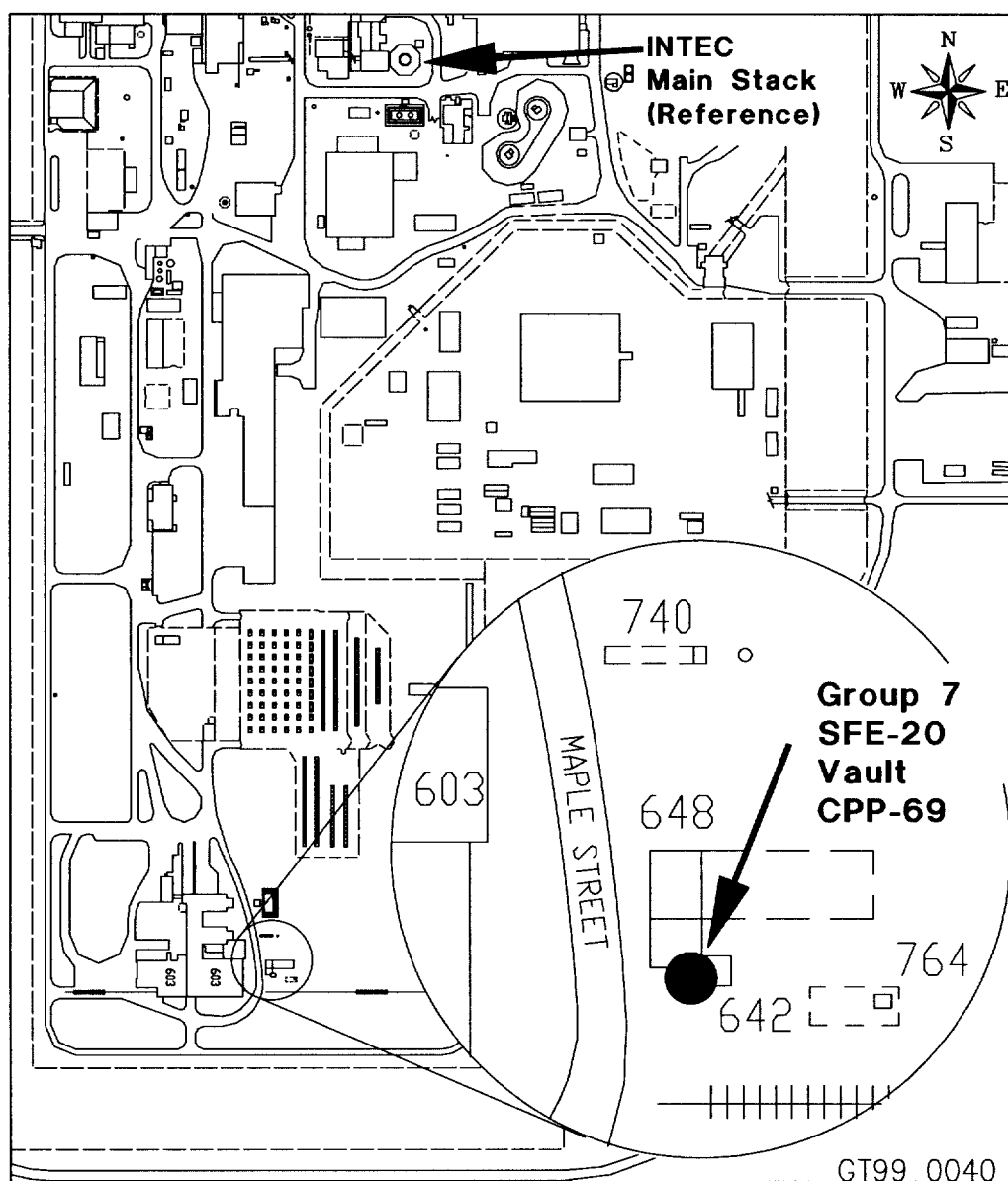
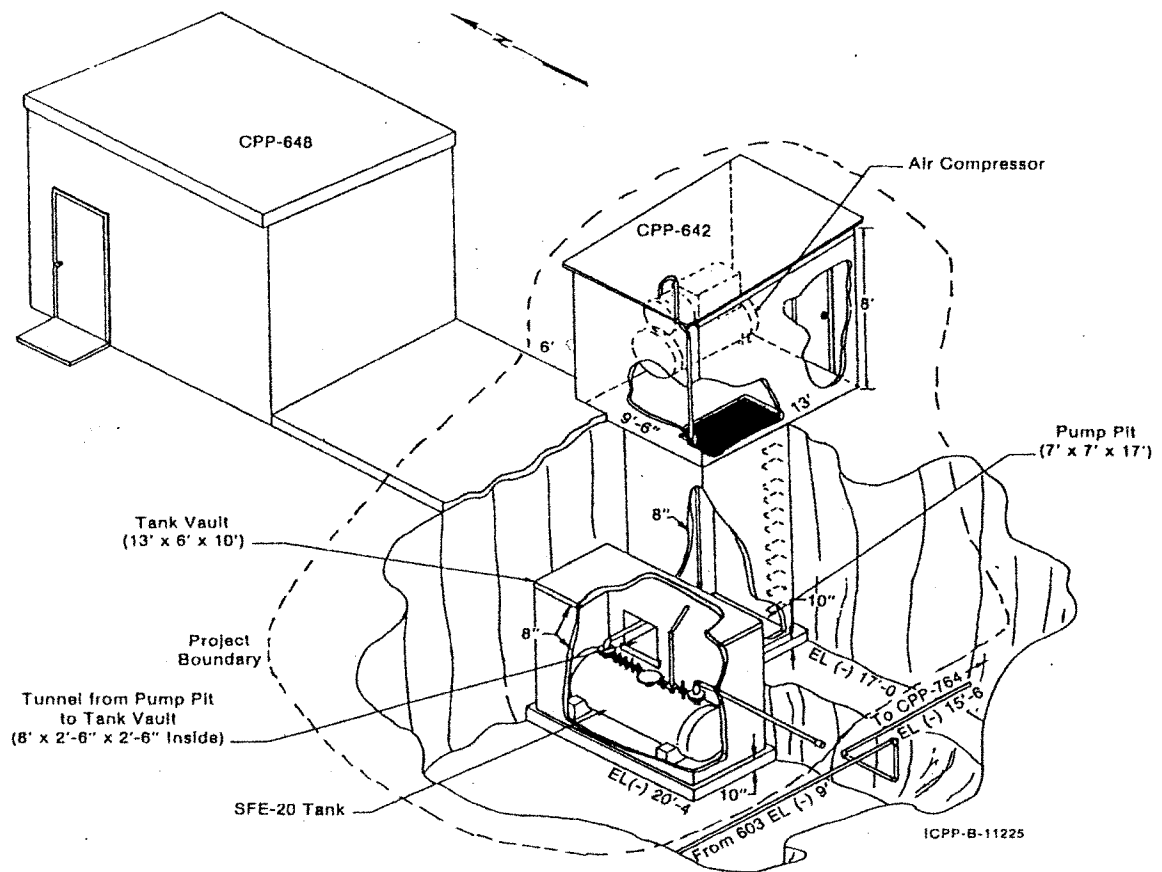


Figure 1-3. Location of the VES-SFE-20 tank at INTEC.

1.4 VES-SFE-20 Background and Description

The VES-SFE-20 includes the VES-SFE-20 tank, tank vault, access tunnel, associated pump pit, and the CPP-642 compressor building with related piping and instrumentation. Figure 1-4 shows an isometric view of the tank and its vault. The VES-SFE-20 hot waste tank system, including the CPP-642 pump house, was constructed in 1957 to collect low-level liquid wastes from the south basin area of CPP-603 and the Fuel Receiving and Storage Area. Construction of the south basin addition, which includes the Fuel Element Cutting Facility (FECF), was also completed in 1957. The addition was to receive, store, and cut aluminum-clad fuel from the test reactor program at Savannah River.



Isometric view of tank vault and pump pit.

Figure 1-4. Isometric view of the tank vault and pump pit.

Floor drains in the receiving area, decontamination pad, and FECF-collected decontamination solutions may have received liquids from the shipping casks and other hot waste liquids. Liquid wastes flowed by gravity through underground lines to the VES-SFE-20 tank. From the VES-SFE-20 tank, the liquid waste was pumped to WL-102, a holding tank at the Process Equipment Waste (PEW) Evaporator Facility. When FECF fuel cutting operations concluded, acid was added to the VES-SFE-20 tank, and the contents were heated to dissolve the fine cuttings that passed through the strainer in the FECF drains. The tank contents were then flushed to the PEW Evaporator Facility.

The VES-SFE-20 tank is located about 20 ft beneath CPP-642. The tank and contents, tank vault, and pump pit were previously part of Operable Unit (OU) 3-09 and are identified as Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) Site CPP-69, but this project was not sampled under the OU 3-09 Track 2 investigation. Past characterization activities show surface contamination is present in the access tunnel to the pump pit; radioactively contaminated liquid and sediments are present in the tank and on the floor of the tank vault.

Based on historical information, the lines that fed the VES-SFE-20 tank and transferred the waste to the PEW were isolated from this tank and incorporated into other tank systems when the use of the VES-SFE-20 tank was discontinued in 1976. What remains of the tank system will be removed as part of the remedial action described in the OU 3-13 Record of Decision (ROD).

The CPP-642 building is currently being used to house an air compressor no longer in operation. Utilities and transfer lines supporting adjacent waste holding tanks are routed through CPP-642 above the tank vault and access tunnel. Existing characterization data is further described in *Characterization Work Plan for the VES-SFE-20 Hot Waste Tank at INTEC* (DOE-ID 2003a).

1.5 VES-SFE-20 Remedial Action Scope of Work

The selected alternative for VES-SFE-20 is removal, treatment, and disposal of the tank and its contents and ancillary equipment/structures. The scope of this HASP is focused on the removal, disposal of the soil, tank, piping, piping insulation, structures, debris, and associated waste characterization. The following sections identify the work elements required to implement and complete the VES-SFE-20 Phase I and II remediation. Phase I will consist of remediation of the VES-SFE-20 tank and contents. Phase II will address the remedial actions associated with the process equipment, structures and contaminated soils. The extent of the soil contamination in the vicinity of VES-SFE-20 and CPP-642 will be determined following removal of the structures. Utilities and wells in the area will affect the excavation and sampling efforts and extent of soil removal. Additionally, field sampling and screening will be conducted throughout Phase I and II activities to determine the disposition path for waste materials as described in *Waste Management Plan for the VES-SFE-20 Hot Waste Tank System* (DOE-ID 2003b).

1.5.1 Phase I Activities

The VES-SFE-20 tank and contents will be removed in Phase I of the remedial action. The following subsections provide a summary of each of these work elements.

1.5.1.1 Mobilization. Mobilization will include such activities as setup of work zones, lay-down area, moving required equipment to the project site, and obtaining necessary work authorization and permits. Coordination between VES-SFE-20 project personnel and INTEC operations will be implemented during the course of Phase I and II activities to minimize the impact of the VES-SFE-20 project on INTEC operations.

1.5.1.2 Remediation of Tank and Contents. The VES-SFE-20 tank and contents will be removed in Phase I of the remedial action. This section discusses the work elements required for completing this initial phase of the remedial action. Phase I work elements include (1) rerouting active utility lines that have been identified in the design, (2) removing presumed asbestos-containing materials (pipe insulation), (3) excavation activities, (4) removing surface contamination on vault surfaces from the tank, (5) tank and sediment disposition, and (6) temporary closure of vault and excavation.

1.5.1.3 Rerouting of Existing Utilities. Past operations in the immediate area around the VES-SFE-20 tank utilized electrical, steam, water, and other process lines. These utility lines are either

active and in use supporting existing INTEC operations or are inactive and abandoned. The active or abandoned lines that are within the excavation zone or within the VES-SFE-20 tank vault are identified in applicable company documents and procedures. Inactive lines will be cut and capped per the design called out in applicable company documents and procedures. Active lines identified in will be rerouted to support current operations. Phase I excavation activities will require demolition of one abandoned Resource Conservation and Recovery Act (RCRA) process line, cutting and capping of this line. Waste generated from the demolition of the RCRA line will be managed as CERCLA waste and will be disposed of in the INEEL CERCLA Disposal Facility (ICDF). If lines are active, the use of a vacuum excavator may be warranted in compliance with applicable company policies and procedures.

1.5.1.4 Excavation and Sloping and Soil Disposal. Phase I excavation will consist of a sloped excavation to expose the roof of the VES-SFE-20 vault. The vault roof is approximately 10 ft below surface grade. The excavation will extend one ft below the surface of the vault roof to gain access required to cut and remove the roof. Phase I excavation drawings can be found in applicable company documents and procedures. Approximately 355 yd³ of soil will be removed during the Phase I excavation. The soil removed during Phase I will be stockpiled adjacent to the excavation and will be returned to the pit following tank removal and replacement of the vault roof. A standard liner will be placed below the pile and a cover utilized over the soil pile for fugitive dust control. Excavated soil that poses a radiological risk and cannot be returned to the excavation will be disposed of at the ICDF. Details regarding this potential waste stream can be found in the *Waste Management Plan for the VES-SFE-20 Hot Waste Tank System* (DOE-ID 2003b). Standard dust control measures will be employed during all activities involving earthwork.

1.5.1.5 Removal of Tank and Contents. Following excavation to expose the vault, the concrete vault roof will be cut and removed. The vault roof will be disposed of as debris in the ICDF landfill. Prior to removal of the roof, access holes will be drilled to accommodate spray application of a fixative material such as latex paint to the inner surfaces of the vault as a contamination control measure. A contamination control enclosure with a removable top will be utilized during the removal of the vault roof and will be opened as needed to allow extraction of the tank and associated piping. Prior to extraction of the tank, the lines leading to the tank will be cut where they enter the vault and the flanges removed. Blind flanges with lifting lugs will be used to reseal the openings and also aid in rigging the tank for removal. All asbestos-containing insulation on steam lines in the vault and pump pit will be removed during line removal process. The VES-SFE 20 tank contains approximately 30-40 gal of contaminated sediment. This sediment will not be removed separately but will be sealed in the tank and removed in one step with the tank. Details of the vault opening, ancillary line cutting and capping within the vault, and hoisting and rigging of the tank and contents for removal can be found in applicable company documents and procedures. Following tank removal, the interior surfaces of the vault will be cleaned of loose surface contamination. A second application of fixative material will be applied to the interior surfaces of the vault prior placement of a precast cement roof, as needed. Contamination left in place will be appropriately documented.

1.5.1.6 Disposal of Tank and Contents. The anticipated waste streams as a result of this remedial action are the VES-SFE-20 tank containing approximately 30-40 gal of contaminated sediment material, ancillary piping, contaminated sediment, soil and miscellaneous supplies resulting from vault decontamination, and asbestos debris from asbestos abatement activities. Applicable company documents and procedures analyze the treatment and disposal options for the tank and its contents.

The VES-SFE-20 tank and sediment will be packaged per applicable company documents and procedures for shipment to a waste treatment and disposal facility.

Other piping and debris will be disposed of in the ICDF as allowed by the ICDF landfill Waste Acceptance Criteria. The *Waste Management Plan for the VES-SFE-20 Hot Waste Tank System* (DOE-ID 2003b) provides additional details regarding treatment and disposal of the various waste streams resulting from the Phase I remedial action.

1.5.1.7 Vault Closure and Site Grading. It is anticipated that considerable time will elapse before Phase II of the project will be implemented. To keep water out of the excavation and return the area to a safe condition, a temporary roof made of precast concrete will be placed over the vault and the excavation will be backfilled and compacted. The backfill material will be soils that were removed, stockpiled, and covered during the initial excavation. A layer of clean soil may be applied to the surface to reduce the risk of contamination at the surface. Contouring and grading of backfill excavations will be performed to maintain existing surface water flow patterns at the remediation site.

1.5.2 Phase II Activities

Phase II remediation will include remediation of the remaining process equipment, contaminated soil, and demolition and removal of the remaining related structures. This section provides the work elements required to complete the phase II remediation activities.

1.5.2.1 Cutting and Capping Existing Utility Lines. Existing utility lines in building CPP-642 include active air and power distribution to CPP-1677 (VES-SFE-126) and CPP-648 (VES-SFE-106). All active systems will require rerouting during the planned Phase II removal of CPP-642. In addition, numerous active or abandoned process lines cross through the area, which pose interference for shoring systems and excavation equipment. These lines will be identified and rerouted or cut and capped as appropriate outside the excavation area.

An addition to the valve pit that supports CPP-648 (VES-SFE-106) was constructed directly north of the VES-SFE-20 vault. This concrete pipe corridor was doweled into the VES-SFE-20 vault roof and the northwest corner of the CPP-642 pump house. A portion of the corridor is situated directly above the north end of the VES-SFE-20 vault. Thus, a portion of the pipe corridor will require removal with the VES-SFE-20 tank vault. In addition, abandoned sample lines running from the CPP-648 pump house and entering the north side of the VES-SFE-20 vault are located beneath the CPP-648 valve pit addition.

1.5.2.2 Excavation and Shoring. Phase II excavation will consist of a shored excavation that is assumed to extend to basalt. Shoring is required due to the numerous existing structures in the area and the overall depth of the excavation. The bottom of the tank vault is in excess of 20-ft below grade. An excavation boundary was selected such that shoring operations must be contained within that boundary. This boundary was used to generate the volumetric quantities for Phase II. The Phase II excavation will consist of approximately 1,620 yd³ of soil. The subcontractor will be responsible for the development of the shoring design.

1.5.2.3 Building Removal. CPP-642 with related piping and instrumentation will be removed under this phase of the VES-SFE-20 remediation. Above ground building removal will consist of the demolition of CPP-642, a single-story, 13-ft 4-in. × 9-ft 4-in. structure constructed of 6-in. concrete block walls and a steel framed metal deck roof. The interior components of the building will be disconnected and removed first and then the structure demolished and the rubble removed and disposed of at the ICDF.

1.5.2.4 Underground Structure Removal. The underground structure consists of the VES-SFE-20 tank vault, access tunnel, and CPP-642 foundation. These structures will be demolished in place and removed from the excavation. The below-grade structures comprising the VES-SFE-20 tank system will be demolished and removed using conventional demolition equipment and methods. These

structures include the CPP-642 foundation and pump pit, access tunnel and tank vault. The existing pipe corridor will be removed up to the building line of CPP-648. These underground structures are constructed of reinforced concrete. The demolition work will commence from the top down with the above-grade structures removed first, then as the excavation proceeds, the pump pit, access tunnel and tank vault will be removed. The existing pipe corridor will be removed by saw-cutting the roof slab, foundation walls and floor at the building line of CPP-648. A new masonry block wall will be constructed to support the floor slab of CPP-648 and to seal off the below-grade portion of the building. The remaining pipe corridor can then be removed. It is assumed that the contamination levels will allow the concrete demolition work to be performed by using excavators and other demolition equipment to break up the concrete into manageable pieces and removing for disposal at the ICDF.

1.5.2.5 Contaminated Soil Removal. As the concrete structure is removed, the underlying soil will be sampled as directed in the *Field Sampling Plan for the VES-SFE-20 Hot Waste Tank System at INTEC* (DOE-ID 2003c). If found, contaminated soil will be removed. The contaminated soil will only be removed from within the shored area and not “chased” outside the soil/shoring interface. If contaminated soil is found and extends beyond the line of shoring, it will be recorded and later removed as part of the OU 3-13, Group 3, Other Surface Soils, remedial action.

1.5.2.6 Disposal of Process Equipment, Structures, and Contaminated Soil. The contaminated soil from the Phase II remediation activities will be transported directly to ICDF for disposal as discussed in the *Waste Management Plan for the VES-SFE-20 Hot Waste Tank System* (DOE-ID 2003b).

1.5.2.7 Demobilization. Following completion of Phase II remediation activities and decontamination of equipment, the subcontractor will demobilize from the site. The subcontractor will remove any office trailers and associated ancillary equipment from the site. Temporary fencing and signage, and a decontamination pad, if used, will be removed and disposed of appropriately.

1.6 Other Activities

Additional site activities will be conducted to manage storm water and control dust for the eventual site reclamation activities following complete site remediation.

1.6.1 Storm Water Management and Sediment Control

A Storm Water Pollution Prevention Plan will be developed for this project. The plan outlines the measures project personnel must follow in order to be in compliance with INEEL rules and regulations regarding control of storm water and associated sediment.

1.6.2 Dust Control

Precautions such as water spray, wind monitoring, and/or visual observation will be used during any earthmoving activities to prevent the generation of fugitive dust. Air monitoring may be performed at the discretion of the radiological control technician (RCT) or the IH based on their evaluation of the effectiveness of the dust suppression measures to control the spread of contamination through fugitive dust. Personal protective equipment (PPE), when required, shall be used as specified in the project-specific HASP and as determined by the RCT or IH present at the job site.

1.6.3 Site Reclamation

Upon completion of Phase II activities, reclamation of the work sites shall be performed, including areas adjacent to any barriers disturbed during construction, lay down areas, and all areas affected by road work and borrow and stockpiling activities. Because this remediation will not affect any vegetated areas, no seeding or vegetation activities will be required. Gravel fill will be replaced to return the site to its preremediation state in accordance with INEEL guidelines.

1.7 Project Interfaces

The interface agreement between the program and INTEC describes the working relationships for activities and programs conducted at the INTEC. The programs at INTEC are being conducted under the regulatory authority of the CERCLA (42 USC 6901 et seq.); the ROD for INTEC, WAG 3, OU 3-13 (DOE-ID 1999); and the Federal Facility Agreement and Consent Order (DOE-ID 1991).

The project will fall under the purview of the INTEC SAD and will be conducted within the INTEC facility. VES-SFE-20 project activities will be conducted in accordance with the project ASA, this HASP, applicable company policies and procedures, operating procedures (standard and detailed), and work orders where required.

2. HAZARD IDENTIFICATION AND MITIGATION

NOTE: This project will be conducted utilizing both INEEL contractor and subcontractor personnel. Applicable INEEL-specific safety and health subject matter area requirements mentioned in this document are based on an operations approach.

Personnel may be exposed to safety hazards, chemical, radiological, and physical agents while conducting VES-SFE-20 remedial activities. Waste in VES-SFE-20, historical detection of chemical and radionuclide-soil contamination, and the radiation fields from exposing buried waste from VES-SFE-20 all contribute to these potential hazards. Identification and mitigation of these hazards is imperative to prevent injury or exposure to personnel conducting these activities. The primary objective of this section and Section 3 is to identify existing and anticipated hazards associated with VES-SFE-20 remedial activities and to provide controls to eliminate or mitigate these hazards. This includes

- Evaluation of VES-SFE-20 remedial actions to determine the extent that potential industrial safety, radiological, nonradiological, and physical hazards may affect project personnel
- Establishment of the necessary monitoring and sampling required to evaluate exposure and contamination levels, determine action levels to prevent exposures, and provide specific actions to be followed if action levels are reached
- Determination of necessary engineering controls, isolation methods, administrative controls, work practices, and (where these measures will not adequately control hazards) PPE to further protect project personnel from hazards.

The magnitude of danger presented to personnel entering work zones by VES-SFE-20 hazards is dependent on both the nature of tasks being performed and the proximity of personnel to the hazards. Engineering controls will be implemented (whenever possible) along with administrative controls, work practices, and PPE to further mitigate potential exposures and hazards. Formal preplanning (job walk-down, completion of the hazard profile screening checklist, and prejob briefing checklist), written procedures, JSAs, and other work controls will be developed based on the hazards identified in this HASP, applicable company documents and procedures, work packages, and project-specific conditions. These documents will also specify operational hazard mitigation measures to follow.

The following subsections describe the chemical, radiological, safety, and environmental hazards that personnel may encounter while conducting VES-SFE-20 remedial activities. Hazard mitigation provided in this section in combination with other work controls (e.g., technical procedures, work orders, JSA, and applicable company documents and procedures) also will be used where applicable to eliminate or mitigate project hazards in accordance with applicable company documents and procedures.

2.1 Chemical and Radiological Hazards and Mitigation

Past characterization and process knowledge of the VES-SFE-20 tank systems has identified both chemical and radiological contaminants of concern. These contaminants are present in the VES-SFE-20 tank and some piping systems, as well as, hazards associated with the exterior tank structures and piping (for example asbestos insulation). Additional information from the characterization work conducted in February 2003 will need to be evaluated and entered into the tables on the following pages (Tables 2-1 through 2-3) as an update if different information becomes available.

Several tables and a figure are presented in this section that identify the potential hazards that may be encountered during project activities based on past sampling and known operational records and present task-based hazard-specific mitigation measures. These include

- Table 2-1, VES-SFE-20 tank radionuclides and chemicals of concern
- Figure 2-1, Radiological readings within the VES-SFE-20 tank vault
- Table 2-2, Evaluation of agents that may be encountered at the VES-SFE-20 site
- Table 2-3, Summary of project activities, associated hazards, and mitigation.

2.1.1 Routes of Exposure

Exposure pathways exist for radiological and nonradiological contaminants that area likely to be encountered during VES-SFE-20 project activities. Engineering controls, monitoring, training, and work controls will be used to mitigate potential contact and uptake of these hazards; however, the potential for exposure to contaminants still exists. Exposure pathways include those listed below:

- **Inhalation** of radiological and nonradiological contaminated soil or fugitive dusts during Phase I and II tasks and ancillary decontamination tasks. Inhalable or respirable (dependent on the particle aerodynamic diameter) fugitive dusts may have trace amounts of radiological or nonradiological contaminants associated with them, resulting in potential respiratory tract deposition.
- **Skin absorption and contact** with radiological and nonradiological contaminated soil, tank or debris surfaces during Phase I and II tasks. Radiological and nonradiological contaminants can be absorbed through the skin, resulting in uptake through the skin and/or skin contamination.
- **Ingestion** of radiological and nonradiological contaminated materials adsorbed to dust particles or waste residues, resulting in potential uptake of contaminants through the gastrointestinal (GI) tract that may result in GI irritation, internal tissue irradiation, and/or deposition to target organs.
- **Injection** of radiological and nonradiological contaminated materials by breaking of the skin or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

Chemical and radiological hazards will be eliminated, isolated, or mitigated to the extent possible during all VES-SFE-20 project activities. Where they cannot be eliminated or isolated, monitoring for chemical and radiological hazards will be conducted (as described in Section 3) to detect and quantify exposures. Additionally, administrative controls, training, work procedures, and protective equipment will be used to further reduce the likelihood of exposure to these hazards.

The JSAs, radiological work permits (RWPs), and other work control documents will be used in conjunction with this HASP to address specific hazardous operations and radiological conditions. When used, these permits will further detail hold points, and specialized PPE, and dosimetry requirements.

2.2 Safety and Physical Hazards and Mitigation

Industrial safety and physical hazards will be encountered while performing VES-SFE-20 project activities. Section 4.2 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed to eliminate or minimize potential hazards to project personnel.

Table 2-1. VES-SFE-20 tank contaminants of concern.

Contaminant Type	Potential Contaminant of Concern	Concentration	Possible Source
Metals	Cadmium	Unknown	From racks used to store spent fuel in the basins
	Chromium	Unknown	Dissolution of metal alloys
Volatile organic compounds	Acetone	Unknown	Used for decontamination
	Freon	Unknown	From decontamination
	Methylene chloride	Unknown	Likely ingredient in methychlor used for decontamination
	1,1,1-trichloroethane	Unknown	Found in Oakite Swiff used for decontamination
	Tetrachloroethene	Unknown	Used for decontamination
	Formaldehyde (not required per requester)	Unknown	From the chloride removal system
Nonvolatile organic compounds	PCBs	Unknown	Based on process knowledge
Anions	Chlorides	Unknown	Based on process knowledge
	Nitrates	Unknown	Based on process knowledge
Acidity	Potential for hydrogen ion (pH)	Unknown	Nitric acid and hydrochloric acid were added to the tank
Radionuclides	Strontium-90	9,700 pCi/ml	Previously detected (WINCO 1984)
	Cobalt-60	74.3 pCi/ml	Previously detected (WINCO 1984)
	Cesium-134	7.76 pCi/ml	Previously detected (WINCO 1984)
	Cesium-137	2,050 pCi/ml	Previously detected (WINCO 1984)
	Europium-152	Unknown	Isotope below detection level in 1984 (WINCO 1984), decay product found in the tank sediments
	Europium-154	Unknown	Isotope below detection level in 1984 (WINCO 1984), decay product found in the tank sediments
	Europium-155	Unknown	Isotope below detection level in 1984 (WINCO 1984), decay product found in the tank sediments
	Antimony-125	73.2 pCi/ml	Previously detected (WINCO 1984)
	Plutonium-238, -239, -240, -241, -242	Unknown	Previously detected (WINCO 1984); individual was not determined
	Uranium-234, -235, -236, -238	Unknown	Previously detected (WINCO 1984); individual isotopes were not determined
	Cerium-144	Unknown	Decay product
	Zirconium-95	Unknown	Previously detected in the FECF
	Americium-241	Unknown	Decay product of plutonium, found in the sediment of CPP-740
	Neptunium-237	Unknown	Decay product
	Curium-242	Unknown	Decay product
	Potassium-40	Unknown	Previously detected in the FECF

Table 2-1. (continued).

Contaminant Type	Potential Contaminant of Concern	Concentration	Possible Source
	Manganese-54	Unknown	Previously detected in the FECF
	Niobium-95	Unknown	Previously detected in the FECF
	Ruthenium-106	Unknown	Previously detected in the FECF
	Iodine-129	Unknown	Decay product
	Carbon-14	Unknown	Possible activation product
	Tritium	Unknown	Possible activation product
	Radium-226	Unknown	Decay product
	Technetium-99	Unknown	Decay product

2.2.1 Material Handling and Back Strain

Material handling and maneuvering of various pieces of equipment and tools during VES-SFE-20 project activities may result in employee injury. All lifting and material-handling tasks will be performed in accordance with applicable company documents and procedures. Personnel will not physically lift objects weighing more than 22 kg (50 lb) or 33% of their body weight (whichever is less) alone. Additionally, back strain and ergonomic considerations must be given to material handling and equipment usage. Mechanical and hydraulic lifting devices should be used to move materials whenever possible. The IH may conduct ergonomic evaluations during VES-SFE-20 project activities as deemed appropriate to determine the potential ergonomic hazards and provide recommendations to mitigate these hazards. Applicable requirements from applicable company documents and procedures also will be followed.

2.2.2 Repetitive Motion and Musculoskeletal Disorders

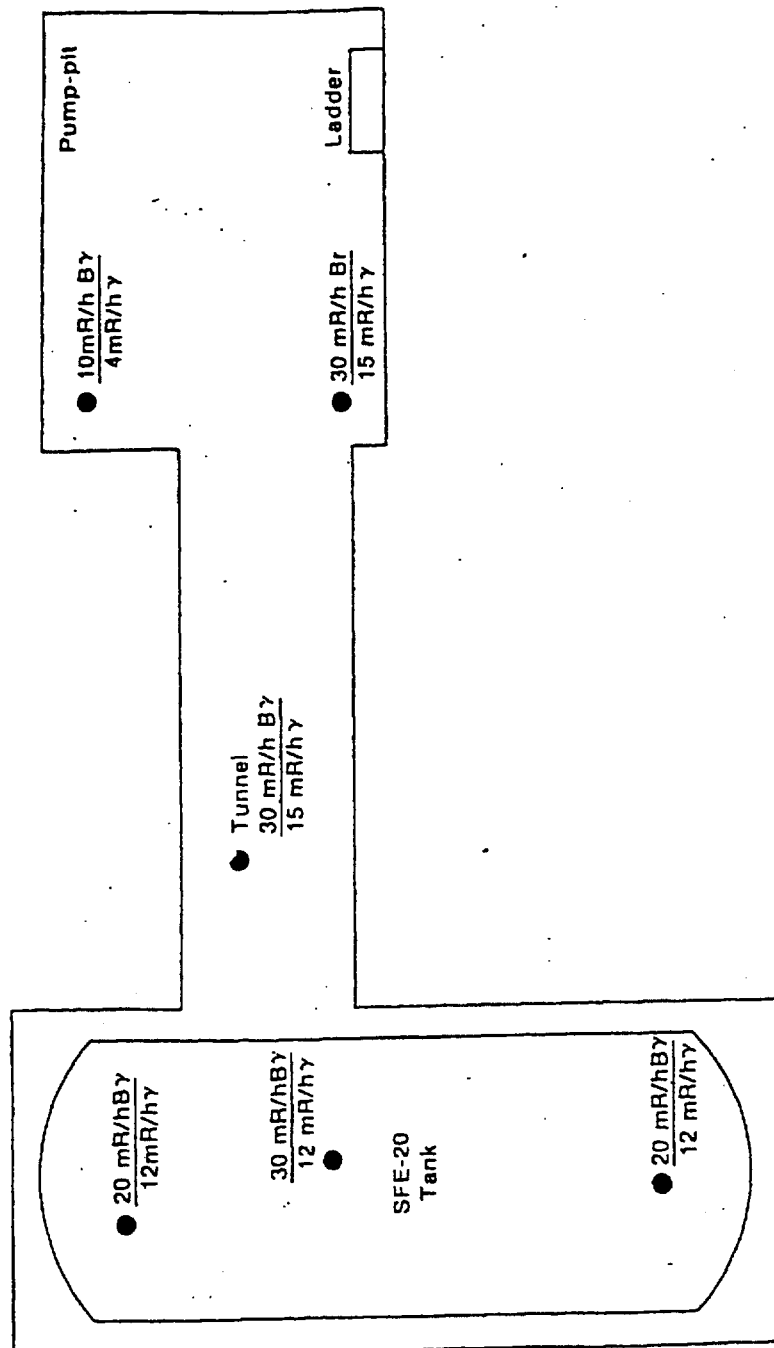
Project operational tasks such as material handling and remediation tasks may expose personnel to repetitive-motion hazards, undue physical stress, overexertion, awkward postures, or other ergonomic risk factors that may lead to musculoskeletal disorders. Musculoskeletal disorders can cause a number of conditions including pain, numbness, tingling, stiff joints, difficulty moving, muscle loss, and sometimes paralysis. The assigned project IH may evaluate project tasks and provide recommendations as deemed appropriate to reduce the potential for musculoskeletal disorders in accordance with applicable company documents and procedures.

2.2.3 Working and Walking Surfaces

Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. Outdoor project activities present inherent tripping hazards because of uneven surfaces and terrain, sloped soil, use of ladders. Additionally, the potential for slip, trip, and fall hazards will increase during winter months because of ice- and snow-covered surfaces. All personnel will be made aware of tripping hazards that cannot be eliminated. Tripping and slip hazards will be evaluated during the course of the project in accordance with applicable company policies and procedures.

2.2.4 Proper Housekeeping to Prevent Slips, Trips, and Falls

Ground surfaces in working areas shall be maintained, so far as possible, in a clean and dry condition. All walking and working surfaces will be kept clean, orderly, and free of foreign objects to prevent possible slip, trip, and fall hazards. Proper drainage and use of dry standing stations will be



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Figure 2-1. Radiological readings within the VES-SFE-20 tank vault (February 1984).

Table 2-2. Evaluation of agents that may be encountered at the VES-SFE-20 project site.

Material or Chemical (CAS #, Vapor Density & Ionization Energy) ^a	Exposure Limit ^b (PEL/TLV)	Routes of Exposure ^c	Indicators or Symptoms of Over-Exposure ^d (Acute and Chronic)	Target Organs/System	Carcinogen? (source) ^e	Source
ORGANIC COMPOUNDS						
Acetone (67-64-1) VD - 2 IE - 9.7 eV	TLV: 500 ppm STEL: 750 ppm	Ih, Ig, Con	Eye, nose and throat irritation; headache; dizziness; CNS depression; dermatitis	Eyes, skin, respiratory system, CNS	No	Unknown, common laboratory cleaning chemical – lab trace contaminant
Diesel fuel (8008-20-6)	TLV: 100 mg/m ³ (as total hydrocarbons)	Ih, Ig, S, Con	Eye irritation; respiratory system changes; dermatitis	Eye, respiratory system	No	Heavy equipment fueling
Diesel exhaust particulate (particulate median cut point aerodynamic diameter 3.5 – 4.0 µm)	TLV: 0.02 mg/m ³ as elemental carbon (ACGIH 2002 notice of intended changes)	Ih	Respiratory, nose, throat or lung irritation with stinging and redness of the eyes; headache; nausea; dizziness; unconsciousness	Respiratory system	A2 – ACGIH	Heavy equipment operation
Formaldehyde (50-00-0) VD – 1.56 IE – 10.9 eV Substance-specific standard 29 CFR 1910.1048	TLV: C 0.3 ppm <u>OSHA</u> AL: 0.5 ppm PEL: 0.75 ppm STEL: 2 ppm	Ih, Ig, Con	Irritant to eyes, noise, throat, cough, bronchial spasm, pulmonary irritation	Eyes, skin, respiratory system	A2-ACGIH	From the chloride removal system
Freon (1,1,1-trichloro- 1,2,2-trifluoroethane) (76-13-1) VD – 6.5 IE – 11.99 eV	TLV: 1000 ppm STEL: 1250 ppm	Ih, Ig, Con	Irritation skin, throat, drowsiness, dermatitis; central nervous system depression; in animals: cardiac arrhythmias, narcosis	Skin, heart, central nervous system, cardiovascular system	No	From previous decontamination

Table 2-2. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy) ^a	Exposure Limit ^b (PEL/TLV)	Routes of Exposure ^c	Indicators or Symptoms of Over-Exposure ^d (Acute and Chronic)	Target Organs/System	Carcinogen? (source) ^e	Source
Methylene chloride (75-09-2) VD – 1.75 IE – 11.4 eV Substance-specific standard 29 CFR 1910.1052	TLV: 50 ppm OSHA PEL: 25 ppm STEL: 125 ppm	Ih, Ig, S, Con	Eye and skin irritation; fatigue, weakness, somnolence, lightheadedness; numbness, tingle limbs; nausea	Eyes, skin, cardiovascular system, CNS	Yes – NIOSH	Likely ingredient in methychlor used for decontamination
1,1,1-trichloroethane (71-55-6) VD – 4.6 IE – 11.2 eV	TLV: 350 ppm STEL: 450 ppm	Ih, Ig, Con	Eye and skin irritation; headache, lassitude, central nervous system depressant/depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, CNS, cardiovascular, liver	No A4 – ACGIH	Found in Oakite Swiff used for decontamination
Tetrachloroethylene (127-18-4) VD – 5.7 IE – 9.3 eV	ACGIH TLV: 25 ppm STEL: 100 ppm PEL: 100 ppm	Ih, Ig, S, Con	Eye, skin, nose, throat, and respiratory system irritation; nausea; flush face, neck; vertigo, dizziness, incoordination; headache, somnolence; skin erythema; liver damage	Eyes, skin, respiratory system, liver, kidneys, CNS	Yes – NIOSH	Used for decontamination
Aroclor-1260 (potential contaminant only)	TLV not established	Ih, S, Con	Eye irritation, eye inflammation, and swelling of adjoining tissues; GI disturbances; discoloration of the nail and skin; cancer hazard; liver damage; delayed adverse health effects; chloracne	Eyes, GI, skin, liver	Yes – NIOSH	Based on process knowledge – specific PCB compound not specified

Table 2-2. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy) ^a	Exposure Limit ^b (PEL/TLV)	Routes of Exposure ^c	Indicators or Symptoms of Over-Exposure ^d (Acute and Chronic)	Target Organs/System	Carcinogen? (source) ^e	Source
Aroclor-1268 (potential contaminant only)	TLV not established	Ih, Ig, S, Con	Chloracne; GI disturbances; eye irritation, inflammation and swelling if the adjoining tissues; discoloration of the nails and skin; liver injury; delayed health effects	Eyes, skin, GI, liver	No	Based on process knowledge – specific PCB compound not specified
INORGANIC COMPOUNDS						
Asbestos (12001-29-5)	TLV: 0.2 fiber/cm ³	Ih, Ig, Con	Irritation of eyes and skin, chronic asbestosis, restricted pulmonary function	Eyes/respiratory tract	AI-ACGIH Yes – NTP Yes – IARC Yes – OSHA	Pipe insulation
Substance-specific standard 29 CFR 1910.1001	<u>OSHA</u> PEL: 0.1 fiber/cm ³ Excursion Limit: 1 fiber/cm ³					
Cadmium (7440-43-9)	TLV: 0.01 mg/m ³ 0.002 mg/m ³ (respirable)	Ih, Ig	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia	Respiratory system, kidneys, prostate, blood	Yes – NIOSH	From racks used to store spent fuel in the basins
Substance-specific standard 29 CFR 1910.1027	<u>OSHA</u> AL: 2.5 µg/m ³ PEL: 5 µg/m ³					
Chloride (7782-50-5) - chlorine compound	TLV based on specific chlorine compound	Ih, Ig, Con	General (Cl ₂): Burning of eyes, nose, mouth; lacrimation (discharge of tears), rhinorrhea (discharge of thin mucus); cough, choking, substernal (occurring beneath the sternum) pain; nausea, vomiting; headache, dizziness; syncope; pulmonary edema; pneumonitis; hypoxemia (reduced oxygen in the blood); dermatitis	General (Cl ₂): eyes, skin, respiratory system	No	Based on process knowledge

Table 2-2. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy) ^a	Exposure Limit ^b (PEL/TLV)	Routes of Exposure ^c	Indicators or Symptoms of Over-Exposure ^d (Acute and Chronic)	Target Organs/System	Carcinogen? (source) ^e	Source
Chromium (7440-47-3)	TLV: Cr-III 0.5 mg/m ³ Soluble Cr-VI 0.05 mg/m ³ Insoluble Cr-VI 0.01 mg/m ³ TWA: 1 mg/m ³	Ih, Ig, Con	Eye and skin irritation; lung fibrosis	Eyes, skin, respiratory system	No	Dissolution of metal alloys
Nitrate/nitrite-N	TLV based on specific compound	No information available	No information available	No information available	No information available	Based on process knowledge
Silica, crystalline (14464-46-1) christobalite	TLV: 0.05 mg/m ³ (respirable fraction) TWA: 10 mg/m ³ /(%SiO ₂ + 2)	Ih, Con	Cough, dyspnea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes	Eyes, respiratory system	OSHA potential	Cutting concrete
<u>Radionuclides (as listed in Table 2-1)</u>						
Radionuclides (whole body exposure from contaminated tank contents/soil/debris/hot particle)	As low as reasonably achievable (ALARA), dose limit-per radiological work permit Posting of radiation areas per applicable company policies and procedures	Whole body	If required, alarming electronic dosimetry used to alert workers to increased gamma radiation fields TLDs for whole body TEDE	Blood-forming cells, GI tract, and rapidly dividing cells	Yes – IARC	VES-SFE-20 hot waste tank contents and associated piping and debris, surrounding soils
Radionuclides (fixed and removable surface contamination)	Posting of contamination areas per applicable company policies and procedures	Ig, Con	Portable contamination instruments, swipes, and personal contamination monitor	GI tract, ionization of internal tissue	Yes – IARL	VES-SFE-20 tank contents, contaminated surfaces, soils, debris, and decontamination waste

Table 2-2. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy) ^a	Exposure Limit ^b (PEL/TLV)	Routes of Exposure ^c	Indicators or Symptoms of Over-Exposure ^d (Acute and Chronic)	Target Organs/System	Carcinogen? (source) ^e	Source
Radionuclides (airborne radioactivity)	ALARA, dose limit, in accordance with a radiological work permit (RWP) 10% of derived air concentration for specific radionuclide selected (10 CFR 835, "Occupational Radiation Protection") Posting of airborne radioactivity areas in accordance with applicable company policies and procedures	Ih, Ig, broken skin	Alarming continuous air monitors, high counts on portable air samplers and personal air samplers	GI tract, ionization of internal tissue through uptake of radionuclides	Yes	Airborne radioactivity resulting from tank content removal, pipe cutting/removal, and other activities where contamination may be aerosolized

a. Material Safety Data Sheets (MSDSs) for chemicals other than waste are available at the project site.

b. American Conference of Governmental Industrial Hygienists (ACGIH) 2002 TLV Booklet and OSHA, 29 CFR 1910, substance-specific standards.

c. (Ih) inhalation; (Ig) ingestion; (S) skin absorption; (Con) contact hazard.

d. (Nervous system) dizziness/nausea/lightheadedness; (dermis) rashes/itching/redness; (respiratory) respiratory effects; (eyes) tearing/irritation.

e. If yes, identify agency and appropriate designation (ACGIH A1 or A2, NIOSH, OSHA, IARC, NTP).

AL = OSHA Action Limit	CAS = Chemical Abstract Service	CNS = central nervous system	GI = gastrointestinal
IARC = International Agency for Research on Cancer	IH = industrial hygienist	NIOSH = National Institute of Occupational Safety and Health	
NTP = National Toxicology Program	PEL = permissible exposure limit	RCM = radiological control manual	TEDE = total effective dose equivalent
TLV = thermoluminescent dosimeter	TLV = threshold-limit value	TWA = time-weighted average	

Table 2-3. Summary of project activities, associated hazards, and mitigation^a.

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
PHASE I TASKS - REMEDIATION OF TANK AND CONTENTS		
Mobilization, demobilization and site reclamation	<p>Equipment movement and vehicle traffic—trailers, forklift, pinch points, and struck-by or caught-between potential.</p> <p>Lifting and back strain—staging containers and support materials, material movement, installation/removal of fencing and posts, anchoring trailers, lifting/carrying hoisting and rigging equipment.</p> <p>Tripping hazards and working-walking surfaces—uneven surfaces/terrain, ice- and snow-covered surfaces, and truck decks, and ladder use.</p>	<p>JSA's, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, watch body position, and wear PPE.</p> <p>Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).</p> <p>Identify potential slip/trip/fall hazards of project site walking/working surfaces and mitigate or mark where possible, keep working surfaces clear of debris/sand ice and move cords and lines out of walkways where feasible, wear required footwear, ladder training, 3-point contact when ascending/descending ladder.</p> <p>Identify and mark overhead hazards where practical and wear head protection (hard hat).</p> <p>IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on a safe work permit (SWP) (or equivalent) as required.</p>
Rerouting of existing utilities and lines	<p>Radiological contamination—process lines and surrounding soil surface.</p> <p>Radiation exposure—pipe content (with a dose rate).</p>	<p>Evaluate line content in a sequential manner to determine content and potential hazards, radiological work permit (RWP) (as required), RCT surveys, hold points, shielding (as required), direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.</p>

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Chemical and nonradiological contaminants—waste in process lines and surrounding soil, cutting/capping lines, refueling.		Evaluate line content in a sequential manner to determine content and potential hazards, control pipe effluent during cutting task, trained fuel handlers, engineering controls, personnel position upwind during cutting tasks, controlled access, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.
Lifting and back strain—staging new lines and support materials, process line section movement, lifting/carrying hoisting and rigging equipment.		Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
Equipment movement and vehicle traffic—excavator, forklift, and industrial vehicle operations, pinch points, and struck-by or caught-between potential.		JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, clear swing radius during excavation tasks, body position awareness, and wear high visibility vests, and PPE.
Stored and live energy sources—electrical, mechanical, thermal, elevated materials, potential pressurized systems, excavator, hoisting and rigging (H&R), rolling vehicles.		Outage and/or subsurface investigation to identify and mark all utilities, hand digging around piping, logout/tagout (LO/TO) training, LO/TO in accordance with applicable company documents and procedures, ensure all lines and cords are checked for damage, use ground fault circuit interrupter (GFCI) on outdoor equipment, comply with minimum clearances for overhead lines, conduct inspections of H&R equipment, set brake and use tire chocks where appropriate, clear swing radius of excavator during operation.
Tripping hazards and working and walking surfaces—uneven surfaces and terrain, piping, materials and debris, ice- and snow-covered, and wet surfaces.		Awareness of walking surfaces, utilize established walkways/ramps/routes, remove debris and materials from walking/working surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.
Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.		IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Excavation, sloping, and soil disposal	Hazardous noise—cutting lines, areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and hearing protection devices.
	Pinch points/cuts or lacerations—cutting and capping lines, threading pipe, sharp pipe edges/ends.	Identify potential sharp objects, provide temporary caps as necessary to protect sharp ends, utilize cutting tools with guards, wear required PPE including eye/face protection and leather gloves for all cutting and sharp material handling tasks.
	Radiological contamination—potentially contaminated soil.	RCT surveys, hold points, RWP (as required), direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.
	Radiation exposure—hot particles and contamination (with a dose rate).	
	Chemical and nonradiological contaminants—potentially contaminated soil, refueling.	Wet excavation areas as necessary to minimize dust, trained fuel handlers, engineering controls, controlled access, position personnel upwind during excavation tasks, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.
	Respirable dust—particulates not otherwise specified.	Wet excavation areas as necessary to minimize dust, utilize soil cover, conduct baseline and periodic air monitoring to establish exposure levels for affected personnel as deemed appropriate by IH.
	Lifting and back strain—staging soil containers, lifting/carrying liner and other materials/equipment.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Equipment movement and vehicle traffic—excavator, forklift, and industrial vehicle operations, pinch points, overhead hazards, and struck-by or caught-between potential.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, clear swing radius area during excavation tasks, watch body position, and wear high visibility vests and required PPE.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Stored and live energy sources—electrical, mechanical, thermal, elevated materials, potential pressurized systems, excavator, rolling vehicles.	Outage and/or subsurface investigation to identify and mark all utilities, hand digging around any piping/roof, LO/TO training, applicable work packages, LO/TO in accordance with applicable company documents and procedures, clear swing radius before initiating excavation tasks, ensure all lines and cords are checked for damage, use GFCI on outdoor equipment, comply with minimum clearances for overhead lines, set brake and use tire chocks where appropriate, wear high visibility vests and other PPE. A competent person inspects excavation in accordance with applicable company documents and procedures. Barricade excavation from vehicle/equipment traffic where required.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, piping, materials and debris, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, utilize established walkways/ramps/routes, remove debris and materials from walking/working surfaces, salt and sand icy areas, and use nonskid or high-traction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and hearing protection devices.
Removal of tank and contents	Radiological contamination—tank/piping surface, vault area, and waste contents. Radiation exposure—waste or contamination surfaces (with a dose rate).	Fix contamination with fixative spray, high-efficiency particulate air (HEPA)-filtered vacuum for cleaning vault debris, RCT surveys, hold points, RWP, direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Chemical and nonradiological contaminants—waste in tank/pipes, asbestos on piping, silica from concrete drilling/cutting, refueling, spray fixative compound.	Trained fuel handlers, engineering controls, controlled access, area monitors and direct reading instruments, JSAs, use wet concrete sawing method, personal air monitoring for silica (as deemed appropriate by IH), MSDS for all chemicals used, utilize remote applicator for spray fixative material, monitoring, and wear PPE. Conduct all asbestos abatement tasks in accordance with 29 CFR 1910.1001 or 29 CFR 1926.1101, “Asbestos,” and applicable company documents and procedures.
	Lifting and back strain—material movement, staging new flanges and support materials, process line section movement, lifting/carrying piping, hoisting and rigging equipment.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person’s body weight (whichever is less).
	Equipment movement, vehicle traffic, hoisting and rigging—forklift, and industrial vehicle operations, pinch points, and struck-by or caught-between potential, overhead hazards and suspended loads.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, watch body position, conduct all hoisting and rigging tasks in accordance with applicable company documents and procedures, lift plan (as required), no personnel under suspended load, wear required PPE.
	Stored and live energy sources—electrical, mechanical, thermal, elevated materials, potential pressurized systems, rolling vehicles.	Outage and/or subsurface investigation to identify and mark all utilities, hand digging around piping, LO/TO training, applicable work packages, LO/TO in accordance with applicable company documents and procedures, ensure all lines and cords are checked for damage, use GFCI on outdoor equipment, comply with minimum clearances for overhead lines, conduct inspections of hoisting and rigging equipment, set brake and use tire chocks where appropriate.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Tripping hazards and working and walking surfaces—entry into vault area, excavated slopes, cords/lines/debris, ladder usage, uneven surfaces and terrain, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, clear working/walking surfaces of cords and debris (where feasible), utilize established ramps, 3-point contact with ladder when ascending/descending and ladder training in accordance with applicable company policies and procedures, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Pinch points/cuts or lacerations—cutting and capping lines, drilling and cutting concrete vault roof, threading pipe, sharp pipe edges/ends, removing/installing new flanges/lifting fixtures.	Identify potential sharp objects, provide temporary caps as necessary to protect sharp ends, utilize cutting/sawing tools with guards, body position awareness and use of mechanical lifting device to lift/position heavy flanges, no body parts under suspended load, wear required PPE including eye/face protection and leather gloves for all cutting and sharp material handling tasks.
	Hazardous noise—drilling and cutting roof/piping, areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and hearing protection devices.
	Confined space entry—vault area entry.	Review existing/complete confined space evaluation form, eliminate atmospheric and safety hazards prior to entry (where feasible), trained entrants/attendants/entry supervisor, conduct monitoring of space prior to entry, and utilize permit system in accordance with applicable company documents and procedures.
Disposal of tank and contents	Radiological contamination—tank sediment, piping, soil and debris. Radiation exposure—contamination associated with waste materials and debris (with a dose rate).	Confinement of contaminated materials, minimize direct handling, RCT surveys, shielding (as required), hold points, RWP, direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Vault closure and site grading	Chemical and nonradiological contaminants—tank sediment, piping, soil, debris, and asbestos.	Isolation of materials with barriers/confining layer, engineering controls, controlled access, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE. Conduct all asbestos abatement tasks in accordance with 29 CFR 1910.1001 or 29 CFR 1926.1101, “Asbestos,” and applicable company documents and procedures.
	Lifting and back strain—staging waste for removal, containerizing waste, waste container handling/positioning/movement, lifting/carrying hoisting and rigging equipment.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person’s body weight (whichever is less).
	Equipment movement and vehicle traffic—forklift, and industrial vehicle operations, pinch points, and struck-by or caught-between potential, suspended load, overhead hazards.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, watch body position, and wear PPE.
	Tripping hazards and working and walking surfaces—open excavation slopes, lines/cords, debris, uneven surfaces and terrain, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, clear working/walking surfaces of cords and debris (where feasible), utilize established ramps, salt and sand icy areas, and use nonskid or high-friction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and PPE (as required).
Vault closure and site grading	Radiological contamination—fixed contamination on vault surfaces, and potentially surrounding soil. Radiation exposure—contamination (with a dose rate).	RCT surveys, hold points, RWP, direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Chemical and nonradiological contaminants—refueling additional fixative as required.	Trained fuel handlers, controlled access, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.
	Lifting and back strain—handling liner on stockpiled soils.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Equipment movement, vehicle traffic, excavator swing radius, and hoisting and rigging—forklift, industrial vehicle, crane operations, pinch points, struck-by or caught-between potential, overhead hazards.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, hoisting and rigging in accordance with applicable company policies and procedures, designated traffic lanes and areas, watch body position, clear excavator swing radius, wear high visibility vests, no one under suspended loads, and PPE.
	Tripping hazards and working and walking surfaces—open excavation slopes, lines/cords, debris, uneven surfaces and terrain, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, clear working/walking surfaces of cords and debris (where feasible), utilize established ramps, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and PPE (as required).

PHASE II TASKS – Remediation of Process Equipment, Structures and Contaminated Soil

Cutting and capping of existing utility lines	<p>Radiological contamination—process lines and surrounding soil surface.</p> <p>Radiation exposure—pipe content (with a dose rate).</p>	<p>Evaluate line content in a sequential manner to determine content and potential hazards, RWP (as required), RCT surveys, hold points, shielding (as required), direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.</p>
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Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Chemical and nonradiological contaminants—waste in process lines and surrounding soil, cutting/capping lines, refueling.	Evaluate line content in a sequential manner to determine content and potential hazards, control pipe effluent during cutting task, trained fuel handlers, engineering controls, personnel position upwind during cutting tasks, controlled access, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.
	Lifting and back strain—staging new lines and support materials, process line section movement, lifting/carrying hoisting and rigging equipment.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Equipment movement and vehicle traffic—excavator, forklift, and industrial vehicle operations, pinch points, and struck-by or caught-between potential.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, clear swing radius during excavation tasks, body position awareness, and wear high visibility vests and PPE.
	Stored and live energy sources—electrical, mechanical, thermal, elevated materials, potential pressurized systems, excavator, H&R, rolling vehicles.	Outage and/or subsurface investigation to identify and mark all utilities, hand digging around piping, LO/TO training, applicable work packages, LO/TO in accordance with applicable company documents and procedures, ensure all lines and cords are checked for damage, use GFCI on outdoor equipment, comply with minimum clearances for overhead lines, conduct inspections of H&R equipment, set brake and use tire chocks where appropriate, clear swing radius of excavator during operation.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, piping, materials and debris, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, utilize established walkways/ramps/routes, remove debris and materials from walking/working surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Hazardous noise—cutting lines, areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and hearing protection devices.
	Pinch points/cuts or lacerations—cutting and capping lines, threading pipe, sharp pipe edges/ends.	Identify potential sharp objects, provide temporary caps as necessary to protect sharp ends, utilize cutting tools with guards, wear required PPE including eye/face protection and leather gloves for all cutting and sharp material handling tasks.
Excavation and shoring	Radiological contamination—potentially contaminated soil.	RCT surveys, hold points, RWP (as required), direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.
	Radiation exposure—hot particles and contamination (with a dose rate).	
	Chemical and nonradiological contaminants—potentially contaminated soil, refueling.	Wet excavation areas as necessary to minimize dust, trained fuel handlers, engineering controls, controlled access, position personnel upwind during excavation tasks, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.
	Respirable dust—particulates not otherwise specified.	Wet excavation areas as necessary to minimize dust, utilize soil cover, conduct baseline and periodic air monitoring to establish exposure levels for affected personnel as deemed appropriate by IH.
	Lifting and back strain—staging soil containers, lifting/carrying materials, and other materials/equipment handling tasks.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Equipment movement and vehicle traffic—excavator, forklift, and industrial vehicle operations, pinch points, overhead hazards, and struck-by or caught-between potential.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, clear swing radius area during excavation tasks, watch body position, and wear high visibility vests and required PPE.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Stored and live energy sources—potential electrical, mechanical, thermal, elevated materials, potential pressurized systems, excavator, rolling vehicles.	Outage and/or subsurface investigation to identify and mark all utilities, hand digging around any piping, LO/TO training, applicable work packages, LO/TO in accordance with applicable company documents and procedures, clear swing radius before initiating excavation tasks, ensure all lines and cords are checked for damage, use GFCI on outdoor equipment, comply with minimum clearances for overhead lines, set brake and use tire chocks where appropriate, wear high visibility vests and other PPE. A competent person inspects excavation in accordance with applicable company documents and procedures. Barricade excavation from vehicle/equipment traffic where required.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, piping, materials and debris, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, utilize established walkways/ramps/routes, remove debris and materials from walking/working surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and hearing protection devices.
Building Removal	Radiological contamination—potentially fixed contamination on structure. Radiation exposure—hot particles and contamination (with a dose rate).	Isolation of contaminated surfaces, wet excavation areas as necessary to minimize dust, RCT surveys, hold points, RWP (as required), direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.
	Chemical and nonradiological contaminants—potentially contaminated soil/surfaces, refueling.	Wet excavation areas as necessary to minimize dust, trained fuel handlers, engineering controls, controlled access, position personnel upwind during excavation tasks, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Respirable dust—particulates not otherwise specified.	Wet excavation areas as necessary to minimize dust, utilize soil cover, conduct baseline and periodic air monitoring to establish exposure levels for affected personnel as deemed appropriate by IH.
	Lifting and back strain—material handling, lifting/carrying equipment, and other materials/equipment handling tasks.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Equipment movement and vehicle traffic—excavator, forklift, and industrial vehicle operations, pinch points, overhead hazards, flying debris, and struck-by or caught-between potential.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, clear swing radius area during excavation tasks, clear area during hydraulic ram operation, closed cab of excavator when conducting demolition activities, watch body position, and wear high visibility vests and required PPE.
	Stored and live energy sources—potential electrical, mechanical, thermal, elevated materials, potential pressurized systems, excavator, rolling vehicles, open excavation.	Outage and/or subsurface investigation to identify and mark all utilities, hand digging around any piping, LO/TO training, applicable work packages, LO/TO in accordance with applicable company documents and procedures, clear swing radius before initiating excavation tasks, ensure all lines and cords are checked for damage, use GFCI on outdoor equipment, comply with minimum clearances for overhead lines, set brake and use tire chocks where appropriate, wear high visibility vests and other PPE. A competent person inspects excavation in accordance with applicable company documents and procedures. Barricade excavation from vehicle/equipment traffic where required.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, piping, materials and debris, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, utilize established walkways/ramps/routes, remove debris and materials from walking/working surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Underground structure and contaminated soil removal	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and hearing protection devices.
	Pinch points/cuts or lacerations—debris with sharp edges/ends.	Identify potential sharp objects and avoid contact or handling when feasible, protect sharp ends, wear required PPE including eye/face protection and leather gloves for all material handling tasks.
	Radiological contamination—potentially fixed contamination on interior vault surfaces. Radiation exposure—hot particles and contamination (with a dose rate).	Isolation of contaminated surfaces, wet excavation areas as necessary to minimize dust, RCT surveys, hold points, RWP (as required), direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.
Silica and respirable dust—particulates not otherwise specified.	Chemical and nonradiological contaminants—potentially contaminated soil/surfaces, additional fixative, refueling.	Wet excavation areas as necessary to minimize dust, trained fuel handlers, engineering controls, controlled access, position personnel upwind during excavation tasks, area monitors and direct reading instruments, JSAs, MSDS for all chemicals used, and PPE.
		Wet excavation areas as necessary to minimize dust, utilize soil cover, conduct baseline and periodic air monitoring to establish exposure levels for affected personnel as deemed appropriate by IH.
	Lifting and back strain—material handling, lifting/carrying soil/waste container liners and other materials/equipment.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Equipment movement and vehicle traffic—excavator, forklift, and industrial vehicle operations, pinch points, overhead hazards, flying debris, and struck-by or caught-between potential.	JSA's, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, clear swing radius area during excavation tasks, clear area during hydraulic ram operation, closed cab of excavator when conducting demolition activities, watch body position, and wear high visibility vests and required PPE.
	Stored and live energy sources—potential electrical, mechanical, thermal, elevated materials, potential pressurized systems, excavator, rolling vehicles, open excavation.	Outage and/or subsurface investigation to identify and mark all utilities, hand digging around any piping, LO/TO training, applicable work packages, LO/TO in accordance with applicable company documents and procedures, clear swing radius before initiating excavation tasks, ensure all lines and cords are checked for damage, use GFCI on outdoor equipment, comply with minimum clearances for overhead lines, set brake and use tire chocks where appropriate, wear high visibility vests and other PPE. A competent person inspects excavation in accordance with applicable company documents and procedures. Barricade excavation from vehicle/equipment traffic where required. Professional engineer design approval of excavation protective system if excavation exceeds 20 ft deep.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, piping, materials and debris, ice- and snow-covered, and wet surfaces.	Awareness of walking surfaces, utilize established walkways/ramps/routes, remove debris and materials from walking/working surfaces, salt and sand icy areas, and use nonskid or high-friction materials on walking surfaces, wear adequate footwear with traction sole.
	Heat and cold stress—working outdoors and tasks requiring use of protective clothing and respiratory protection.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent) as required.
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and PPE (as required).

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Pinch points/cuts or lacerations—debris with sharp edges/ends.	Identify potential sharp objects and avoid contact or handling when feasible, protect sharp ends, wear required PPE including eye/face protection and leather gloves for all material handling tasks.
Disposal of process equipment, structures and contaminated soil	Radiological contamination—waste containers.	RCT surveys, hold points, RWP, direct-reading instruments, compliance with applicable radiological posting requirements, PPE, and use of dosimetry/survey requirements.
	Radiation exposure—associated with contamination (with a dose rate).	
	Chemical and nonradiological contaminants—residual waste on debris or containers, refueling.	Controlled access, area monitor and direct reading instruments as required, JSAs, MSDS for all chemicals used, and PPE.
	Lifting and back strain—staging/positioning waste containers support materials, and hoisting and rigging equipment.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Equipment movement, vehicle traffic, crane—forklift, and industrial vehicle operations, pinch points, and struck-by or caught-between potential, overhead hazards.	JSAs, qualified heavy equipment operator, forklift operators, backup alarms on industrial vehicles, designated traffic lanes and areas, watch body position, no one allowed under suspended loads, all hoisting and rigging conducted in accordance with applicable company documents and procedures, tie down loads on trailers, and wear PPE.
	Stored and live energy sources—elevated materials, hoisting and rigging, rolling vehicles.	Hoisting and rigging in accordance with applicable requirements, stack and stage materials and waste in safe configuration, set brake and use tire chocks where appropriate.
	Tripping hazards and working and walking surfaces—uneven surfaces and terrain, ice- and snow-covered, wet surfaces, trailers.	Awareness of walking surfaces, salt and sand icy areas, and use nonskid or high-friction materials on walking surfaces, wear adequate footwear with traction sole, access trailers using available hand holds and foot platforms.

Table 2-3. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Heat and cold stress—working outdoors.	IH monitoring as required, PPE, training, work and rest cycles as required, stay times documented on SWP (or equivalent).
	Hazardous noise—areas around equipment and when operating some equipment.	Source identification/labeling, IH sound level monitoring and/or dosimetry, isolation, and PPE (as required).
Decontamination tasks	Radiological contamination—contact with waste material/contaminated equipment/components. Radiation exposure—in close proximity to waste containers/contamination with associated dose rate.	RWP, RCT surveys, hold points, direct-reading instruments, collection/counting of swipes, compliance with applicable radiological posting requirements, PPE, use of dosimetry/survey requirements, and ALARA principles (Section 4).
	Chemical and inorganic contaminants—contact with waste material/contaminated equipment/components.	Controlled areas, JSAs, TPRs or work packages, and PPE.
	Pinch points, struck-by/caught-between—equipment/component movement.	JSAs, TPRs, watch body position, and wear PPE.
	Lifting and back strain—moving and positioning components.	Use mechanical lifting and transporting devices, two person lifting if object exceeds 50 lb or is awkward, do not exceed maximum manual lifting limit of 50 lb or 1/3 person's body weight (whichever is less).
	Heat and cold stress—working outdoors and in PPE	IH monitoring as required and work-rest cycles as required.
	Tripping hazards and working-walking surfaces—uneven surfaces/terrain, ice- and snow-covered, wet/slippery containment surfaces.	Awareness of walking surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole, drain standing water through sloping of containment area.
	Electrical—use of electrical equipment or equipment in area where water of wet surfaces are present.	ISA, TPR or work package, use of GFCI outlets or extension cords outdoors and where water or wet surfaces are present, use of barrier material to isolate overspray.

a. All hazards will be identified, evaluated, and controls established in accordance with applicable company policies and procedures requirements. Additionally, project assigned IH, safety professional, and Radiological Control personnel will be available to assist with the applicable company policies and procedures process and to assist in the development of TPRs, work orders/packages, and permits associated with VES-SFE-20 activities.

provided where wet processes (e.g., decontamination) are used that could cause a potential slip and fall hazard. All tools and equipment used during each shift will be placed back in the designated storage location unless required to be left in place. Cords and lines will be routed around walkways, stairs, and entrances and exits to eliminate tripping hazards. Elevated walkways, platforms and working surfaces will be kept clear of potential tripping hazards at all times.

Personnel shall wear appropriate footwear having proper tread for the work to be performed (consider all weather conditions); heavy/durable materials (leather); adequate ankle support; arch support; additional protection as required for the task (steel toe, steel shank, metatarsal, etc.); shock absorption, etc. Footwear can play a role in preventing slips, trips and falls. Because employees are expected to wear the proper work attire for their respective jobs, they must refrain from wearing slick-bottomed shoes during the months when ice is likely.

2.2.5 Elevated Work Areas

Personnel may sometimes be required to work on elevated structures or equipment at heights 1.8 m (6 ft) above the ground or lower surface. During such work, employees shall be protected from falling by the use of guardrail systems, personal fall-arrest systems or fall restraint system (travel restriction system) that prevents personnel from approaching the fall hazard in accordance with applicable company policies and procedures.

Although not anticipated, leading edge work in areas that will not allow for traditional fall protection controls will require a fall protection plan to be prepared in accordance with applicable company policies and procedures.

2.2.6 Powered Equipment and Tools

Powered equipment and tools used during project activities present potential physical hazards (e.g., pinch points, electrical hazards, flying debris, struck-by, and caught-between) to personnel operating them. All portable equipment and tools will be used for its intended use only and properly maintained by qualified individuals in accordance with the manufacturer's specifications. At no time will safety guards be removed during operation. With proper lockout/tagout, guards may be removed for service and maintenance, then replaced and inspected prior to operation. Requirements from applicable company policies and procedures will be followed for all work performed with powered equipment including hand tools. The user will inspect all tools before use.

2.2.7 Electrical Hazards and Energized Systems

Electrical equipment and tools, as well as overhead and underground lines associated with project activities, may pose shock or electrocution hazards to personnel. All electrical utilities and lines shall be considered energized until determined de-energized by tests or other appropriate methods or means. Ground-fault protected electrical circuits and receptacles in combination with safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. All electrical work will be reviewed and completed under the appropriate work controls (e.g., TPRs or work orders). Before conducting electrical work, hazardous energy of the affected system will be brought to a zero energy state through the use of isolation methods in accordance with the applicable INTEC supplemental procedures for the system or component being worked.

If work on energized systems is necessary, these practices will conform to the requirements in applicable company documents and procedures and Parts I through III of the National Fire Protection Association (NFPA) 70E, "Electrical Safety Requirements for Employee Work Places." Additionally, all

electrical and other utilities will be identified before conducting surface penetration maintenance activities in accordance with applicable company documents and procedures.

2.2.8 Fire and Flammable Materials Hazards

Fuel will be required for the excavator and other equipment during project operations. Flammable hazards include transfer and storage of flammable or combustible liquids in the project operations area. Portable fire extinguishers with a minimum rating of 10A/60BC shall be strategically located at the facility to combat Class ABC fires. Portable fire extinguishers will be located in all active project operations areas, on or near all facility equipment that has exhaust heat sources, and on or near all equipment capable of generating ignition or having the potential to spark. When storing project chemicals, applicable company documents and procedures will be consulted to evaluate compatible storage. The applicable requirements will be followed at all times.

2.2.8.1 Combustible Materials. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. The assigned fire protection engineer should be contacted if questions arise about potential ignition sources. The accumulation of combustible materials will be strictly controlled in all project operational areas including the surrounding project and support trailers area. Class A combustibles (e.g., trash, cardboard, rags, wood, and plastic) will be properly disposed of in appropriate waste containers. The fire protection engineer also may conduct periodic site inspections to ensure all fire protection requirements are being met.

2.2.8.2 Flammable and Combustible Liquids. Fuel used at the project for fueling the excavator and generator(s) must be safely stored, handled, and used. Only portable containers approved by Factory Mutual and Underwriters Laboratories (labeled with the contents) will be used to store flammable liquids. All fuel containers will be stored at least 50 ft from any facilities and ignition sources, stored inside an approved flammable storage cabinet or tank meeting the requirements of NFPA 30, "Flammable and Combustible Liquids Code." Portable motorized equipment (e.g., generators and light plants) will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions before being refueled to minimize the potential for a fuel fire.

2.2.8.3 Welding, Cutting, or Grinding. Personnel conducting welding, cutting, or grinding tasks may be exposed to molten metal, slag, and flying debris. Welding, cutting, or grinding on painted surfaces must be conducted under the direction of an IH with the prescribed engineering controls and associated PPE. Additionally, a fire potential exists if combustible materials are not cleared from the work area. Requirements from applicable company policies and procedures will be followed whenever these types of activities are conducted.

2.2.9 Pressurized Systems

Compressor will likely be operated in support of project activities. The hazards presented to personnel, equipment, facilities or the environment because of inadequately designed or improperly operated pressure systems (vessels) include blast effects, shrapnel, fluid jets, equipment damage, personnel injury, and death. These systems can include pneumatic, hydraulic or compressed gas systems. The applicable requirements in applicable company policies and procedures and the manufacturer's operating and maintenance instructions must be followed. This includes inspection, maintenance, and testing of systems and components in conformance with applicable American National Standards Institute (ANSI) requirements.

All pressure systems will be operated in the designed operating pressure range, which is typically 10 to 20% less than the maximum allowable working pressure. Additionally, all hoses, fittings, lines,

gauges, and system components will be rated for the system for at least the maximum allowable working pressure (generally the relief set point). The project safety professional should be consulted about any questions of pressure systems in use at the project site.

2.2.10 Compressed Gases

Compressed gases may be used in support of project operations. If used, all cylinders will be used, stored, handled, and labeled in accordance with applicable company policies and procedures. All transportation, handling, storage, and use of compressed-gas cylinders will be conducted in accordance with the Compressed Gas Association pamphlet P-1-1965, "Safe Handling of Compressed Gases" (CGA 1965). Additionally, the assigned project safety professional should be consulted about any compressed gas cylinder storage, transport, and use issues.

2.2.11 Equipment and Industrial Vehicle Hazards

The excavator, industrial vehicles, and forklifts will likely be used in support of project activities. Hazards associated with the operation of the excavator and forklifts include injury to personnel (such as struck-by and caught-between hazards), equipment contact with the structures, and property damage. All equipment will be operated in the manner in which it was intended and in accordance with the manufacturer's instructions or equipment design. Only authorized qualified personnel (such as heavy equipment operators) will be allowed to operate heavy equipment. Personnel in proximity to operating equipment must maintain visual communication with the operator and stay out of the equipment swing radius. Personnel also must comply with the applicable requirements of the following:

- DOE-STD-1090-2001, Chapter 10, "Forklift Trucks"
- Any applicable company documents and procedures.

Additional safe practices will include the following:

- All parked unattended heavy equipment will have the bucket or tines in the lowered position (resting on ground).
- All heavy equipment and industrial vehicles will have backup alarms.
- Walking directly behind or to the side of equipment without the operator's knowledge is prohibited.
- While operating equipment in the work area, the equipment operator will maintain communication with a designated person who will be responsible for providing direct voice contact or approved standard hand signals. In addition, all facility personnel in the immediate work area will be made aware of the equipment operations.
- All equipment will be operated away from established traffic lanes and personnel access ways (whenever possible) and will be stored so as not to endanger personnel at any time.
- All unattended equipment will have appropriate reflectors or be barricaded if left on or adjacent to roadways.
- All parked equipment will have the parking brake set and chocks will be used when equipment is parked on inclines.

- Personnel will be protected from the excavator swing radius. This may be accomplished by any or a combination of the following as determined appropriate by the safety professional and documented in work control, (1) the swing radius area may be barricaded or marked to warn personnel, (2) train personnel on the swing radius and the safe work practices required for the task and work location, or (3) shutting down the excavator when personnel are working inside the swing radius area.

2.2.12 Excavation, Surface Penetrations, and Outages

Project utility rerouting and other tasks will require excavation activities. All surface penetrations and related outages will be coordinated through the field team leader (FTL) or subcontractor technical representative (STR) and will require submittal of an outage request for outages (e.g., road, electrical, and water). The submission of an outage request will not be considered an approval to start the work. If lines are active, the use of vacuum excavator may be warranted in compliance with applicable company documents and procedures.

Other specific outage requirements are addressed in the special conditions section of the management and operating contract. **No surface penetrations will be allowed or conducted until the area has been evaluated and an approved subsurface evaluation documented.**

All excavation activities will be conducted and monitored in accordance with applicable company policies and procedures and 29 CFR 1926, Subpart P, “Excavations.” The following are some key elements from these requirements:

- The location of utility installations (e.g., sewer, telephone, fuel, electric, water lines, or any other underground installations) that may reasonably be expected to be encountered during excavation work will be determined before opening an excavation.
- Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design and will be constructed in accordance with the design. Structural ramps will be inspected in accordance with applicable company forms.
- Employees exposed to public vehicular traffic will be provided with and will wear warning vests or other suitable garments marked with or made of reflecting or high-visibility material.
- Daily inspections of excavations, areas adjacent to the excavations, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection will be conducted by the competent person before the start of work and as needed throughout the shift. Inspections also will be made after every rainstorm or other hazard-increasing occurrence.
- Sloping or benching will be constructed and maintained in accordance with the requirements set forth in 29 CFR 1926, Subpart P, Appendix A, for the soil type as classified by the competent person. This classification of the soil deposits will be made based on the results of at least one visual inspection and at least one manual analysis or a designation of soil classification Type C may be selected.

- Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment
- Protective systems for use in excavations more than 20 ft in depth must be designed by a registered professional engineer in accordance with 1926.652(b) and (c).

2.2.13 Hoisting and Rigging of Equipment

A hoisting and rigging will be required to support remedial activities. All hoisting and rigging operations will be performed in accordance with applicable company policies and procedures, and DOE-STD-1090-01 as applicable to project tasks.

Hoisting and rigging equipment will show evidence of a current inspection (e.g., tag) and be inspected before use by designated operators. Additionally, if mobile crane or boom trucks are used in support of project tasks, the operator or designated person for mobile cranes or boom trucks will perform a visual inspection each day or before use (if the crane has not been in regular service) of items such as, but not limited to, the following:

- All control mechanisms for maladjustment that would interfere with proper operation
- Crane hooks and latches for deformation, cracks, and wear
- Hydraulic systems for proper oil level
- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage
- Hoist ropes for kinking, crushing, birdcaging, and corrosion
- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

NOTE: The operator or other designated person will examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they will be reported to the project safety professional.

2.2.14 Overhead Hazards

Personnel may be exposed to overhead impact (contact) hazards during the course of the project activities from climbing in, between, and around heavy equipment and existing structures. Sources for these hazards will be identified and mitigated in accordance with applicable company policies and procedures. In the case of overhead falling hazards, they will be mitigated by using engineering-controls protective systems where there is a potential for falling debris, in combination with head protection PPE.

2.2.15 Personal Protective Equipment

Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. In addition, PPE can increase the risk of heat stress. Work activities at the task site will be modified as necessary to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply with applicable company policies and procedures. Furthermore, all personnel who wear PPE will be trained in its use and limitations in accordance with applicable company policies and procedures.

2.2.16 Decontamination

Decontamination of tank and vault surfaces, powered equipment, tools, and components may be required based on the nature of the remedial activities and extent of contamination. Decontamination procedures for personnel and equipment are detailed in Section 11. Potential hazards to personnel conducting decontamination tasks include back strain; slip, trip, and fall hazards; and cross-contamination from contaminated surfaces. Additionally, electrical hazards may be present if water is used in areas with exposed electrical cords or receptacles. Mitigation of these walking working surfaces and electrical hazards are addressed in prior subsections. If a power washer or heated power washer is used, units will be operated in accordance with manufacturer's operating instructions, personnel will wear appropriate PPE to prevent high-pressure spray injuries, use GFCI protection, and these tasks will only be conducted in approved areas. Personnel will wear required PPE at all times during decontamination tasks as listed in Section 5 and as listed on the associated JSA and RWP where required.

2.3 Environmental Hazards and Mitigation

Potential environmental hazards to personnel exist during project remedial activities. These hazards will be identified and mitigated to the extent possible. This section describes these environmental hazards and states the procedural and work practices will be followed to mitigate them.

2.3.1 Noise

Personnel performing project operations activities may be exposed to noise levels that exceed 85 decibel A-weighted (dBA) from the excavator trucks, hand tools, and compressors. A time-weighted average (TWA) of 84 dBA will be applied for a 10-hour work shift.. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear and temporary or permanent hearing loss
- Interference with communication that would warn of danger.

Where noise levels are suspected of exceeding 80 dBA, noise measurements will be performed in accordance with applicable company policies and procedures to determine if personnel exposures are in excess of the applicable TWA (85 dBA for 8 hours of exposure or lower TWA for 10- or 12-hour work-shift exposures).

NOTE: Exposures exceeding 8-hours per day will be evaluated by the assigned project IH.
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Personnel whose noise exposure routinely meets or exceeds the allowable TWA will be enrolled in the INEEL Occupational Medical Program (OMP) (or subcontractor hearing conservation program as applicable). Personnel working on jobs that have noise exposures greater than 85 dBA will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection specified by the IH until directed otherwise. Hearing protection devices will be selected and worn in accordance with applicable company policies and procedures.

2.3.2 Heat/Cold Stress and Ultraviolet Light Hazards

Project tasks will be conducted during times when there is a potential for both heat and cold stress that could present a potential hazard to personnel. The assigned IH will be responsible for obtaining meteorological information to determine if additional heat or cold stress administrative controls are required.

All personnel must understand the hazards associated with heat and cold stress and take preventive measures to minimize the effects. Applicable company policy and procedure guidelines will be followed when determining work and rest schedules or when to halt work activities because of temperature extremes.

2.3.2.1 Heat Stress. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort, to unconsciousness, to death. In addition, operational tasks requiring the use of PPE or respiratory protection prevent the body from cooling. Personnel must inform their supervisor when experiencing any signs or symptoms of heat stress or observing a fellow employee experiencing such symptoms.

Heat stress stay times will be documented by the IH on the appropriate work control document(s); that is, an SWP, prejob briefing form, or other documents when personnel wear PPE that may increase heat body burden. These stay times will take into account the amount of time spent on a task, the nature of the work (i.e., light, moderate, or heavy), type of PPE worn, and ambient work temperatures. Table 2-4 lists heat stress signs and symptoms of exposure.

Individuals showing any of the symptoms of heat exhaustion listed in Table 2-4 shall do the following:

- Stop work
- Exit or be helped from the work area
- Remove and decontaminate PPE (as applicable)

Table 2-4. Heat stress signs and symptoms of exposure.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating.	Keep the skin clean, change all clothing daily, and cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps and exhaustion, sometimes with dizziness or periods of faintness.	Move the patient to a nearby cool place; give the patient half-strength electrolytic fluids; if cramps persist, or if signs that are more serious develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; <u>cold, clammy skin</u> ; <u>heavy perspiration</u> ; total body weakness; dizziness that sometimes leads to unconsciousness.	Move the patient to a nearby cool place, keep the patient at rest, give the patient half-strength electrolytic fluids, treat for shock, and seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; <u>dry, hot skin</u> ; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching.	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

- Move to sheltered area to rest
- Be provided cool drinking water
- Be monitored by a medic or employee certified in cardiopulmonary resuscitation (CPR) and first-aid.

Monitoring for heat stress conditions shall be performed in accordance with applicable company policies and procedures. Depending on the ambient weather conditions, work conditions, type of PPE worn, and the physical response of work operations personnel, the IH shall inform the FTL, STR, or RCT of necessary adjustments to the work and rest cycle. Additionally, physiological monitoring may be conducted to determine if personnel are replenishing liquids fast enough. A supply of cool drinking water will be provided in designated eating areas and consumed only in these areas. Project personnel may periodically be interviewed by the IH, RCT, or safety professional to ensure that the controls are effective and that excessive heat exposure is not occurring. Workers will be encouraged to monitor personal body signs and to take breaks if symptoms of heat stress occur.

NOTE: Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. The FTL, STR, or health and safety officer (HSO) should immediately request an ambulance (777 or 526-1515) be dispatched from the CFA-1612 medical facility and the individual cooled as described above in Table 2-4 based on the nature of the heat stress illness.

2.3.2.2 Low Temperatures and Cold Stress. Personnel will be exposed to low temperatures during fall and winter months or at other times of the year if relatively cool ambient temperatures combine with wet or windy conditions. The IH will be responsible for obtaining meteorological information to determine if additional cold stress administrative controls are required. Applicable company policies and procedures discuss the hazards and monitoring of cold stress. Table 2-5 provides the cold stress work and warm-up schedule if cold stress conditions exist (late fall, winter, early spring).

Additional cold weather hazards may exist from working on snow- or ice-covered surfaces. Slip, fall, and material-handling hazards are increased under these conditions. Every effort must be made to ensure walking surfaces are kept clear of ice. The assigned project safety professional should be notified immediately if slip or fall hazards are identified at any project location.

2.3.2.3 Ultraviolet Light Exposure. Personnel will be exposed to ultraviolet light (UV) (sunlight and potential during welding) when conducting project activities. Sunlight is the main source of UV known to damage the skin and to cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. No UV rays or suntans are safe. The following mitigative actions may be taken to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long-sleeve or short-sleeve shirt [no tank tops])
- Use a sunscreen with a sun protection factor of at least 15
- Wear a hat (hard hat where required)
- Wear UV-absorbing safety glasses

Table 2-5. Cold stress work and warmup schedule.

Air Temperature °F (approximate)	No Noticeable Wind		Wind 5 mph		Wind 10 mph		Wind 15 mph		Wind 20 mph	
	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks
-15 to -19°	Normal breaks	1	Normal breaks	1	75 minutes	2	55 minutes	3	40 minutes	4
-20 to -24°	Normal breaks	1	75 minutes	2	55 minutes	3	40 minutes	4	30 minutes	5
-25 to -29°	75 minutes	2	55 minutes	3	40 minutes	4	30 minutes	5	Nonemergency work should cease	
-30 to -34°	55 minutes	3	40 minutes	4	30 minutes	5	Nonemergency work should cease			
-35 to -39°	40 minutes	4	30 minutes	5	Nonemergency work should cease					
-40 to -44°	30 minutes	5	Nonemergency work should cease							
-45° and below	Nonemergency work should cease									

- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m. whenever possible
- Select protective clothing and eye protection for welding tasks in accordance with applicable company policies and procedures.

2.3.3 Confined Spaces

Work in confined spaces may subject personnel to risks involving engulfment, entrapment, oxygen deficiency, and toxic or explosive atmospheres. The VES-SFE-20 in configured in such a manner that it is considered a confined space as defined by applicable company policies and procedures. Based on the potential hazards (radiological and asbestos), entries in to the vault area will be conducted as permit-required confined space entries and all requirements of applicable company policies and procedures will be followed. Other entries will be evaluated by the project IH on a case-by-case basis to determine if permit-required entry conditions exist.

2.3.4 Biological Hazards

The project area and support structures provide habitat for various rodents, insects, and vectors (i.e., organisms that carry disease-causing microorganisms from one host to another). The potential also exists for encountering nesting materials or other biological hazards and vectors. Hantavirus may be present in the nesting and fecal matter of deer mice. If such materials are disturbed, it can become airborne and create a potential inhalation pathway for the virus. Contact and improper removal of these materials may provide additional inhalation exposure risks.

If suspected rodent nesting or excrement material is encountered, the assigned IH will be notified immediately and **no attempt will be made to remove or to clean the area**. Following an evaluation of the area, disinfection and removal of such material will be conducted in accordance with applicable company policies and procedures.

Snakes, insects, and arachnids (e.g., spiders, ticks, and mosquitoes) also may be encountered at the project. Common areas to avoid include material stacking and staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter. Protective clothing will generally prevent insects from direct contact with the skin. If potentially dangerous snakes or spiders are found or are suspected of being present, warn others, keep clear, and contact the assigned IH for additional guidance as required.

Insect repellant (DEET or equivalent) may be required. Areas where standing water has accumulated (e.g., evaporation ponds) provide breeding grounds for mosquitoes and should be avoided. In cases where a large area of standing water is encountered, it may be necessary to pump the water out of the declivity (areas other than the established ditches and evaporation ponds).

2.3.5 Inclement Weather Conditions

When inclement or adverse weather conditions develop that may pose a threat to persons or property at the project area (e.g., sustained strong winds 25-mph or greater, electrical storms, heavy precipitation, or extreme heat or cold) these conditions will be evaluated and a decision made by the IH, safety professional (SP), RCT, and other operations personnel, as appropriate, to stop work, employ compensatory measures, or proceed with operations. The FTL and project personnel shall comply with applicable company policies and procedures, facility work control documents, and design requirements that specify limits for project activities.

2.4 Other Project Hazards

Project personnel should continually look for potential hazards and immediately inform the FTL, STR or safety and health personnel of the hazards so that action can be taken to correct the condition. All personnel have the authority to initiate STOP WORK actions in accordance with applicable company policies and procedures if it is perceived that an imminent safety or health hazard exists or take corrective actions within the scope of the work control authorization documents to correct minor safety or health hazards and then inform the FTL or STR.

Personnel working at the project are responsible to use safe-work practices, report unsafe working conditions, near misses or acts, and exercise good housekeeping habits during project operations with respect to tools, equipment, and waste.

2.5 Site Inspections

The FTL, STR, IH, SP, RCT, and operations personnel may participate in project site inspections during the work control preparation stage of the project (e.g., the hazard identification and verification walkdowns), and conduct self-assessments or other inspections. Additionally, periodic safety inspections will be performed by the operations supervisors and assigned health and safety professionals in accordance with applicable company policies and procedures.

Targeted or required self-assessments will be performed during project operations in accordance with applicable company policies and procedures as directed by the operations manager or shift supervisor. All inspections and assessments will be documented and available for review by the shift supervisor, as a minimum. Health and safety professionals present during project operations may, at any time, recommend changes in work habits to the shift supervisor. However, all changes that may affect the facility written work control documents (e.g., HASP, JSAs, RWPs, and work orders) must have concurrence from the appropriate operations technical discipline representative onsite and applicable forms prepared for the applicable document as required.

3. EXPOSURE MONITORING AND SAMPLING

The potential for exposure to chemical, radiological and physical hazards exists during VES-SFE-20 project activities and affect all project personnel conducting remedial activities. Refinement of work control zones (see Section 7), use of engineering and administrative controls, worker training, and wearing of PPE provide the mitigation strategy for these hazards. Monitoring and sampling will be used during project tasks to (1) assess the effectiveness of these controls, (2) determine the type of PPE needed for individual tasks, and (3) determine the need for upgrading and downgrading of PPE as described in Section 5. Monitoring with direct-reading instruments will be conducted as deemed appropriate to provide Radiological Control (RadCon) and IH personnel with real-time data to assess the effectiveness of these control measures.

Tables provided in this section present the strategy for conducting exposure monitoring and sampling. These include

- Table 3-1: Tasks and hazards to be monitored, frequency, and monitoring instrument category
- Table 3-2: Monitoring instrument category and description
- Table 3-3: Action levels and associated responses for specific hazards.

3.1 Action Limits

Action limits (Table 3-3) serve as the initial limits for specific project activities where refinement of work control zones, engineering and administrative controls, worker training, and the use of protective equipment is necessary to mitigate exposures to personnel. Monitoring results at or above an action limit, identified through exposure monitoring, will initiate additional evaluations including consideration for improved engineering controls, administrative controls, reevaluation of personal protective equipment, and probable need for additional exposure monitoring based on the IH's recommendations. Action limits may be adjusted based on changing site conditions, exposure mitigation practices, and PPE levels.

3.2 Environmental and Personnel Monitoring

RadCon and IH personnel will conduct initial and periodic monitoring of project activities with direct-reading instruments, collect swipes, and conduct full- and partial-period air sampling, as deemed appropriate, in accordance with the applicable company policies and procedures. As new remedial activities are planned or hazards are introduced, they will be evaluated and controlled in accordance with applicable company policies and procedures.

OSHA substance-specific standard monitoring for asbestos, cadmium, methylene chloride, and formaldehyde will be conducted in accordance with regulatory requirements to quantify exposures based on exposure assessments and IH professional judgment. Instrumentation listed on Table 3-2 will be selected based on the site-specific conditions and contaminants associated with project tasks. The RCT and IH will be responsible for determining the best monitoring technique for radiological and nonradiological contaminants (respectively) based on project site-specific conditions. Safety hazards and other physical hazards will be monitored and mitigated as outlined in Section 2.

Table 3-1. Tasks and hazards to be monitored, frequency, and monitoring instrument category.

Tasks	Hazard(s) to be Monitored ^a	Instrument Category to be Used
Phase I activities	Ionizing radiation—(alpha, beta, gamma)	1
	Radionuclide contamination—(alpha, beta, gamma)	2
	Organic solvents (including methylene chloride and formaldehyde)	3, 4
	Metals, particulates, and fibers (including cadmium and asbestos)	3, 4
	Respirable dust—silica (area and personal)	3, 5
	Hazardous atmosphere (confined space)	6 ^a
	Hazardous noise	7
	Ergonomics, repetitive motion, lifting	8
	Heat and cold stress	9
Phase II activities	Ionizing radiation—(alpha, beta, gamma)	1
	Radionuclide contamination—(alpha, beta, gamma)	2
	Organic solvents (including methylene chloride and formaldehyde)	3, 4
	Metals, particulates, and fibers (including cadmium and asbestos)	3, 4
	Respirable dust—(area and personal)	4, 5
	Hazardous atmosphere (confined space)	6 ^a
	Hazardous noise	7
	Ergonomics, repetitive motion, lifting	8
	Heat and cold stress	9
Decontamination	Ionizing radiation—(alpha, beta, gamma)	1
	Radionuclide contamination—(alpha, beta, gamma)	2
	Organic solvents (including methylene chloride and formaldehyde)	3, 4
	Metals, particulates, and fibers (including cadmium and asbestos)	3, 4
	Hazardous noise	7
	Ergonomics, repetitive motion, lifting	8
	Heat and cold stress	9

a. Optional sensors based on site-specific contaminants.

Table 3-2. Monitoring instrument category and description.

Instrument Category	Instrument Category Number Description ^a
1	(Alpha) count rate—Bicron NE/Electra (DP-6 or AP-5 probe) or equivalent Stationary—Eberline RM-25 (HP-380AB or HP-380A probe) or equivalent (Beta-gamma) count rate—Bicron NE/Electra (DP-6, BP-17 probes) or equivalent Stationary—Eberline RM-25 (HP-360AB probe) or equivalent
2	Continuous air monitor (CAM)—ALPHA 6-A-1 (in-line and radial sample heads, pump, RS-485) or equivalent (as required) CAM (beta)—AMS-4 (in-line and radial head, pump RS-485) or equivalent (as required) Grab sampler—SAIC H-810 or equivalent
3	Organic vapor—Direct reading instruments (photoionization detector, flame ionization detector, or infrared detector) detector tubes or grab samples Dust—Direct-reading instrument (miniram or equivalent)
4	Organic vapors, metals, and fibers—Personal sampling pumps with appropriate media for partial and full period sampling using National Institute for Occupational Safety and Health (NIOSH) or OSHA-validated methods
5	Silica dust, respirable particulates—NIOSH 7500, NIOSH 0600 or equivalent, personal sampling pump, with cyclone, full-period sampling
6	Oxygen/lower exposure limit (LEL) multi-gas instrument (MSA 361 or equivalent) with additional sensors for expected atmospheric contaminants
7	ANSI Type S2A sound level meter or ASA S1.25-1991 dosimeter (A-weighted scale for time-weighted average dosimetry, C-weighted for impact dominant sound environments)
8	Observation and ergonomic assessment of activities in accordance with applicable company policies and procedures and ACGIH TLV
9	Heat stress—wet-bulb globe temperature, body weight, fluid intake Cold stress—ambient air temperature, wind chill charts

a. Equivalent instrumentation other than those listed may be used.

Table 3-3. Action levels and associated responses for project hazards.

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels are Exceeded
Nonradiological nuisance particulates (particulates not otherwise specified)	<p>>10 mg/m³ (inhalable fraction)</p> <p>>3 mg/m³ (respirable fraction)</p>	<ol style="list-style-type: none"> 1. Substitute equipment or change method to reduce emissions at source 2. Verify engineering control operation (where in place) or institute engineering controls 3. Evaluate air movement (wind) conditions and reschedule tasks or reposition personnel to upwind position of source 4. Move operation to alternant location (with engineering controls if possible) 5. Use wetting or misting methods to minimize dust and particulate matter 6. <u>IF</u> wetting or misting methods prove ineffective, <u>THEN</u> don respiratory protection^a (as directed by IH).
Nonradiological airborne contaminant (chemical, dust fume, fiber, or particulate)	<p>Based on individual contaminant exposure limit (ACGIH TLV or OSHA PEL) and 29 CFR 1910 or 29 CFR 1926 substance-specific requirements.</p> <p>Generally, sustained levels at the TLV or PEL in the worker's breathing zone for two minutes should be used as action limit. Where ceiling values or OSHA substance-specific action limit exists, use these values.</p>	<ol style="list-style-type: none"> 1. Substitute equipment or change method to reduce emissions at source 2. Verify engineering control operation (where in place) or institute engineering controls 3. Evaluate air movement (wind) conditions reschedule tasks or reposition personnel to upwind position of source 4. Move operation to alternant location (with engineering controls if possible) 5. <u>IF</u> engineering and administrative controls do not control contaminant below action/exposure limit, <u>THEN</u> reevaluate engineering and administrative controls or don respiratory protection^a (as directed by IH) 6. <u>IF</u> OSHA substance-specific standard action limit is exceeded, <u>THEN</u> initiate applicable medical surveillance requirements.

Table 3-3. (continued).

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels are Exceeded
Nonradiological hazardous atmosphere	As defined in applicable company policies and procedures, confined spaces are based on criteria such as oxygen level, individual contaminant IDLH value, and LEL.	<ol style="list-style-type: none"> 1. Eliminate hazardous atmosphere through use of engineering controls. 2. Reschedule operations when area or space will not have hazardous atmosphere. 3. Evaluate space or area to be entered. <u>IF</u> the operation can be conducted outside the area or space, <u>THEN</u> perform operation without entry. 4. Measure atmosphere before initiating operation or personnel entry and verify acceptable entry conditions have been met (e.g., oxygen and LEL) and use engineering controls to maintain safe atmosphere and below specified exposure limit. Use permit system to authorize entry. 5. <u>IF</u> engineering control fails to control contaminant below safe atmospheric and exposure limit, <u>THEN</u> stop operation and evacuate personnel until safe atmosphere and specified entry conditions can be achieved. 6. <u>IF</u> IDLH atmosphere must be entered, <u>THEN</u> don appropriate air supplied respiratory protection (with escape capacity) and protective clothing^b. At least one stand-by person dressed in proper PPE must be present for each entrant.
Chemical immediately dangerous to life or health (IDLH), oxygen-deficient, oxygen-enriched, 10% of chemical LEL	<p>NOTE: <i>No entry into an area or confined space containing a hazardous atmosphere is permitted without the authorization of the project health and safety professionals, in conjunction with project manager or representative being informed.</i></p> <p><i>This authorization will be demonstrated through the use of approved operational procedures, work order or confined space entry permit for confined spaces.</i></p>	<p>NOTE: <i>The INEEL fire department also must be notified for any area or space entry into an IDLH atmosphere to ensure adequate rescue equipment and resources are in place.</i></p>

Table 3-3. (continued).

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels are Exceeded
Airborne radioactivity (area or within the confined space)	As defined by applicable company policies and procedures. Concentrations ($\mu\text{Ci}/\text{cm}^3$) $>30\%$ of and derived air concentration value (10 CFR 835.603(d))	<ol style="list-style-type: none"> 1. Eliminate airborne radioactivity source through use of engineering controls and removable contamination lockdown spray. 2. Reschedule operations when area or space following contamination lockdown spray application. 3. Evaluate space or area to be entered. <u>IF</u> the operation can be conducted outside the area or space, <u>THEN</u> perform operation without entry. 4. Conduct ALARA Review and generate RWP with limiting conditions. 5. Post as "Airborne Radioactivity Area"—required items: Radiological Worker (RW) II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required). 6. Determine airborne radioactivity and contamination levels before initiating operation or personnel entry and verify acceptable entry conditions have been met and use engineering controls to maintain safe atmosphere and below specified RWP limit. Use RWP to authorize work. 7. <u>IF</u> engineering control fails to control contaminant below RWP limiting condition limits, <u>THEN</u> stop operation and evacuate personnel until RWP limiting conditions can be achieved. 8. <u>IF</u> IDLH atmosphere must be entered, <u>THEN</u> don appropriate air supplied respiratory protection (with escape capacity) and protective clothing^b. At least one stand-by person dressed in proper PPE must be present for each entrant.

NOTE: The INEEL fire department also must be notified for any area or confined space entry into an IDLH atmosphere to ensure adequate rescue equipment and resources are in place.

Table 3-3. (continued).

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels are Exceeded
Hazardous noise levels	<85 dBA 8-hour TWA, <84 dBA 10-hour TWA 85 to 114 dBA (a) >115 dBA (b) >140 dBA	No action. Hearing protection required to attenuate hazard to below 85 dBA 8-hour TWA or 84 dBA for 10-hour TWA (device noise reduction rating [NRR]). (a) Isolate source, evaluate NRR for single device, double protection as needed. (b) Control entry, isolate source, only approved double protection worn.
Radiation field	<5 mrem/hour 5 to 100 mrem/hour @ 30 cm (10 CFR 835.603(b)) >100 mrem to 500 rad @ 100 cm (10 CFR 835.603(b))	No action, no posting required. Post as “Radiation Area”—Required items: Radiological Worker I or II training, RWP, personal dosimetry. Post as “High Radiation Area”—Required items: RW II, RWP, alarming personal dosimetry, dose rate meter, and temporary shielding (as required).
Radionuclide contamination	1 to 100 times company values ^c (10 CFR 835.603(d)) >100 times company values ^c (10 CFR 835.603(d))	Post as “Contamination Area”—Required items: RW II training, personal dosimetry, RWP, don personal protective equipment (PPE), bioassay submittal (as required). Post as “High Contamination Area”—Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).
Other facility or INEEL alarms	Project operations, RWMC, or INEEL alarm	See Section 10.6 for emergency response action following facility or INEEL alarms.

a. Level C respiratory protection will consist of a full-face respirator equipped with a HEPA filter cartridge as prescribed by the project IH and RadCon personnel (based on contaminant of concern). See Section 5 for additional Level C requirements.

b. Protective clothing to be selected by the IH in consultation with RadCon personnel based on the nature of the task and contaminants and hazards to be encountered.

c. Applicable company policies and procedures.

3.2.1 Industrial Hygiene Area and Personal Monitoring and Instrument Calibration

The assigned OU 7-10 project IH will conduct full- and partial-period sampling of airborne contaminants and monitoring of physical agents during operations at a frequency deemed appropriate based on direct-reading instrument readings and changing conditions. When performed, all air sampling will be conducted using applicable National Institute of Occupational Safety and Health (NIOSH), OSHA, or other validated method. Both personal and area sampling and remote sensing monitoring may be conducted.

Various direct-reading instruments may be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by OU 7-10 project operations conditions, direct-reading instrument results, observation, professional judgment, and in accordance with the applicable company policies and procedures.

All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, existing IH protocol, and in conformance with applicable company policies and procedures and in conformance with the applicable companywide safety and health manuals. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded as stated in Section 12.

3.2.2 Area Radiological Monitoring and Instrument Calibration

Radiological monitoring of radiation and contamination will be conducted during project activities to ensure that personnel are given adequate protection from potential radiological exposure. Instruments and sampling methods listed in Table 3-2 may be used by the RCT as deemed appropriate and as required by general or task-specific RWPs. When conducted, monitoring will be performed in accordance with applicable company manuals. The data obtained from monitoring will be used by RadCon personnel to evaluate the effectiveness of project engineering controls, decontamination methods and procedures, and to alert personnel to potential radiation sources.

All portable survey instruments will be source-checked daily to ensure they are within the specified baseline calibration limits. Accountable radioactive sources will be maintained in accordance with applicable company policies and procedures. All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations, existing RadCon protocol, in accordance with applicable company policies, manuals, and procedures.

3.2.3 Personnel Radiological Exposure Monitoring

Personal radiological monitoring will be conducted during project operational activities to quantify radiation exposure and potential for uptakes as stated in the general or task-specific RWP. This will include the use of external dosimetry, surface monitoring, and internal dosimetry methods where deemed appropriate to ensure that engineering controls, administrative controls, and work practices are effectively mitigating radiological hazards. General as low as reasonably achievable (ALARA) considerations are discussed further in Section 4.4.

3.2.3.1 External Dosimetry. Dosimetry requirements will be based on the radiation exposure potential during project activities. Personnel entering INTEC areas may be required to wear a minimum of a thermoluminescent dosimeter and, at the project site, other personal dosimetry devices (e.g., albedo dosimetry) specified by RadCon personnel, in applicable project RWPs, and in accordance with the applicable company manuals.

The Radiological Control and Information Management System (RCIMS) will be used to track external radiation exposures to project personnel and to serve as the administrative control mechanism for working in accordance with individual RWPs. Individual project personnel are responsible for ensuring all required personal information is provided to RadCon personnel for entry into RCIMS and logging in when electronic dosimeters are used.

3.2.3.2 Internal Monitoring. The purpose of internal dose monitoring is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes that may occur. Internal dose evaluation programs will be adequate to demonstrate compliance with 10 CFR 835, "Occupational Radiation Protection." The requirement for whole body counts and bioassays will be based on project activities or specific tasks and will be the determination of the assigned project radiological engineer (RE). If bioassays are deemed appropriate by the RE, requirements will be specified on the RWP and personnel will be responsible for submitting required bioassay samples upon request.

